

PB-249 695

MONITORING VINYL CHLORIDE AROUND POLYVINYL CHLORIDE
FABRICATION PLANTS

PEDCo-Environmental Specialists, Incorporated

Prepared for:

Environmental Protection Agency

October 1975

DISTRIBUTED BY:

NTIS

National Technical Information Service
U. S. DEPARTMENT OF COMMERCE

056027

PB 249 695

EPA-450/3-75-084

October 1975

**MONITORING
VINYL CHLORIDE
AROUND POLYVINYL
CHLORIDE FABRICATION
PLANTS**



Reproduced by
**NATIONAL TECHNICAL
INFORMATION SERVICE**
U.S. Department of Commerce
Springfield, VA. 22151

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Air and Waste Management
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711

TECHNICAL REPORT DATA (Please read Instructions on the reverse before completing)		
1. REPORT NO. EPA-450/3-75-084	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Monitoring Vinyl Chloride Around Polyvinyl Chloride Fabrication Plants	5. REPORT DATE Issue - October 1975	6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S)	8. PERFORMING ORGANIZATION REPORT NO.	
9. PERFORMING ORGANIZATION NAME AND ADDRESS PEDCo Environmental Specialists, Inc. Suite 13, Atkinson Square Cincinnati, Ohio 45246	10. PROGRAM ELEMENT NO.	11. CONTRACT GRANT NO. 68-02-1375 TO 20
12. SPONSORING AGENCY NAME AND ADDRESS Environmental Protection Agency Research Triangle Park, N.C. 27711	13. TYPE OF REPORT AND PERIOD COVERED Final	14. SPONSORING AGENCY CODE
15. SUPPLEMENTARY NOTES		
16. ABSTRACT A program to measure vinyl chloride emissions from polyvinyl chloride fabrication plants was carried out. Four charcoal collectors were stationed around each of five PVC fabrication plants. 24-hour samples were collected daily for 14 days around each plant. Analysis of the collected samples was by GC. Most of the samples contained less than the minimum detectable amount of VCM ($1 \mu\text{g}/\text{m}^3 = \sim 0.5\text{PPB}$ 24-hour average). The maximum quantity of VCM found in any sample was $17.9 \mu\text{g}/\text{m}^3 (= 7\text{PPB})$.		
17. KEY WORDS AND DOCUMENT ANALYSIS		
a. DESCRIPTORS Vinyl Chloride, Polyvinyl Chloride, PVC Fabrication plants.	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
PRICES SUBJECT TO CHANGE		
18. DISTRIBUTION STATEMENT Release Unlimited	19. SECURITY CLASS (This Report) Unclassified	21. NO. OF PAGES 111
	20. SECURITY CLASS (This page) Unclassified	22. PRICE 5.50 - 2.25

ATTENTION

AS NOTED IN THE NTIS ANNOUNCEMENT,
PORTIONS OF THIS REPORT ARE NOT LEGIBLE.
HOWEVER, IT IS THE BEST REPRODUCTION
AVAILABLE FROM THE COPY SENT TO NTIS.

Direct questions resulting from illegibility to:

Mr. Harold G. Richter

EPA - OAWM - OAQPS

Monitoring & Data Analysis Division

RTP. NC 27711

Phone: 688-8146 X 351

FTS: 629-5351

**MONITORING
VINYL CHLORIDE
AROUND POLYVINYL
CHLORIDE FABRICATION
PLANTS**

by

PEDCo-Environmental Specialists, Inc.
Suite 13, Atkinson Square
Cincinnati, Ohio 45246

Contract No. 68-02-1375
Project No. 20

EPA Project Officer: Harold G. Richter

Prepared for

ENVIRONMENTAL PROTECTION AGENCY
Office of Air and Waste Management
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711

October 1975

ib

This report is issued by the Environmental Protection Agency to report technical data of interest to a limited number of readers. Copies are available free of charge to Federal employees, current contractors and grantees, and nonprofit organizations - as supplies permit - from the Air Pollution Technical Information Center, Environmental Protection Agency, Research Triangle Park, North Carolina 27711; or, for a fee, from the National Technical Information Service, 5285 Port Royal Road, Springfield, Virginia 22161.

This report was furnished to the Environmental Protection Agency by PEDCo-Environmental Specialists, Inc. Cincinnati, Ohio 45246, in fulfillment of Contract No. 68-02-1375. The contents of this report are reproduced herein as received from PEDCo-Environmental Specialists, Inc. The opinion, findings, and conclusions expressed are those of the author and not necessarily those of the Environmental Protection Agency. Mention of company or product names is not to be considered as an endorsement by the Environmental Protection Agency.

Publication No. EPA-450/3-75-084

ACKNOWLEDGMENT

This report was prepared for the U.S. Environmental Protection Agency by PEDCo-Environmental Specialists, Inc., Cincinnati, Ohio. Mr. Lawrence Elfers was the PEDCo Project Manager. Principal authors of the report were Messrs. Anthony Wisbith, Everett Barnett and Lawrence Elfers.

Mr. Harold Richter was the Project Officer for the Environmental Protection Agency. The authors appreciate the many contributions made to this study by Mr. Richter and other members of the National Environmental Research Center in Raleigh, North Carolina.

TABLE OF CONTENTS

	<u>Page</u>
ACKNOWLEDGMENT	iii
1.0 INTRODUCTION	1-1
2.0 SAMPLING LOCATIONS	2-1
2.1 Specific Monitoring Activities	2-3
2.1.1 Ford Company Vinyl Plant	2-3
2.1.2 Sylvania Electric Corporation	2-5
2.1.3 Congoleum Company	2-6
2.1.4 Reynolds Metals Company	2-8
2.1.5 Charlotte Plastics	2-10
2.1.6 Royal Electric, Division of ITT	2-12
3.0 SAMPLING AND ANALYTICAL TECHNIQUES	3-1
3.1 Sampling Equipment	3-1
3.2 Field Operations	3-3
3.2.1 Meteorological Measurements	3-3
3.3 Analytical Procedures	3-4
3.3.1 Preparation of Standards	3-4
3.3.2 Desorption of Vinyl Chloride from Charcoal	3-5
3.3.3 Analytical Method	3-6
3.3.4 Desorption Efficiency	3-6
3.4 Quality Assurance Data	3-8
3.4.1 NBS Vinyl Chloride Reference Samples	3-8
3.4.2 Split Samples	3-12
3.4.3 Calibrating Hypodermic Needles	3-12
4.0 RESULTS AND CONCLUSIONS	4-1
4.1 Maximum Detected Levels	4-1
4.1.1 Ford Vinyl Plant	4-1

TABLE OF CONTENTS (continued).

	<u>Page</u>
4.1.2 Congoleum Company	4-2
4.1.3 Reynolds Metals	4-2
4.2 Conclusions	4-5
APPENDIX A SAMPLING SITE DESCRIPTIONS	A-1
APPENDIX B METEOROLOGICAL DATA SUMMARY	B-1
APPENDIX C EPA METHOD FOR THE ANALYSES OF VINYL CHLORIDE	C-1
APPENDIX D FIELD OPERATORS GUIDE	D-1
APPENDIX E AMBIENT VINYL CHLORIDE DATA SUMMARY	E-1

1.0 INTRODUCTION

Vinyl chloride has recently been demonstrated to be a carcinogen. It has been detected in the atmosphere surrounding both vinyl chloride monomer plants and polymerization plants. As a result of these discoveries, the need for ambient air standards for this and similar materials are under investigation by the U.S. Environmental Protection Agency.

The presence of vinyl chloride in the atmosphere surrounding polyvinyl chloride (PVC) fabrication plants has not yet been demonstrated. If it does exist, then State Implementation Plans (SIP) may have to be modified to require surveillance monitoring around these plants. The purpose of this contract was to determine whether the concentration of vinyl chloride near such fabrication plants is of a sufficient magnitude as to require agency action.

To this end an ambient air monitoring program was conducted in the spring of 1975. This program encompassed six sampling areas in the Eastern United States. Five of the sampling areas were in the vicinity of PVC fabrication plants. The sixth was a "control" area near a plastic fabrication plant which did not use PVC. This was designed to provide background data from a similar industrialized

area. Locations were selected by the Monitoring and Reports Branch, Office of Air Quality Planning and Standards, of the U.S. Environmental Protection Agency. Table 1-1 presents the sampling locations and dates of sampling periods. Four sampling sites were located near each plant. The sampling program for each plant site was conducted for 14 consecutive days, during which integrated 24-hour samples were collected on activated charcoal adsorption tubes. The samples were shipped to the PEDCo-Environmental laboratory and analyzed for their vinyl chloride content within 48 hours of sampling. The sampling sites, techniques, analysis, and quality control procedures are described and the monitoring results are presented in this report. No attempt has been made to evaluate the health-related implications of the data.

Table 1-1. VINYL CHLORIDE STUDY AREAS
AND SAMPLING PERIODS

Study area	Sampling period
Ford Motor Company, Vinyl Plant Mt. Clemens, Michigan	February 12 to February 26, 1975
G.T.E. Sylvania, Inc. Warren, Pennsylvania	February 15 to March 1, 1975
Congoleum Industries Marcus Hook, Pennsylvania	March 12 to March 26, 1975
Reynolds Metals Company Packaging Division - Plastics Grottoes, Virginia	March 15 to March 29, 1975
Charlotte Pipe and Foundry Co. Charlotte Plastics Division Monroe, North Carolina	April 10 to April 24, 1975
ITT Royal Electric Division Pawtucket, Rhode Island	May 22 to June 5, 1975

2.0 SAMPLING LOCATIONS

The fabrication plants which were selected are located throughout the Eastern United States. The general geographic location of each site is presented in Figure 2-1 and brief geographic site descriptions are provided as follows:

- ° Ford Motor Company - This plant is located within the city of Mt. Clemens, Michigan. Mt. Clemens has a population of twenty-one thousand and is located approximately three miles west of Lake St. Clair and twenty miles north of Detroit.
- ° G.T.E. Sylvania, Inc. - This plant is located within the city of Warren, Pennsylvania. Warren is a city of thirteen thousand, located in the northwestern section of Pennsylvania within the Allegheny River Valley.
- ° Congoleum Industries - This plant is located in the city of Marcus Hook, Pennsylvania. Marcus Hook is one of the many small industrial towns located along the Delaware River between Philadelphia, Pennsylvania and Wilmington, Delaware.
- ° Reynolds Metals Company - This plant is located near the town of Grottoes, Virginia which is a small town of twelve hundred residents. The area is primarily rural and lies within the Shenandoah Valley, approximately twenty-two miles northwest of Charlottesville, Virginia.
- ° Charlotte Plastics Division - This plant is located in the rural area of Monroe Township, North Carolina. The city of Monroe, North Carolina is approximately four miles southeast and the city of Charlotte, North Carolina is approximately fifteen miles northwest of the plant site.
- ° ITT, Royal Electric Division ITT - This plant is located within the city of Pawtucket, Rhode Island. Pawtucket, a city of eighty-eight thousand, lies at the northern edge of Providence, Rhode Island.

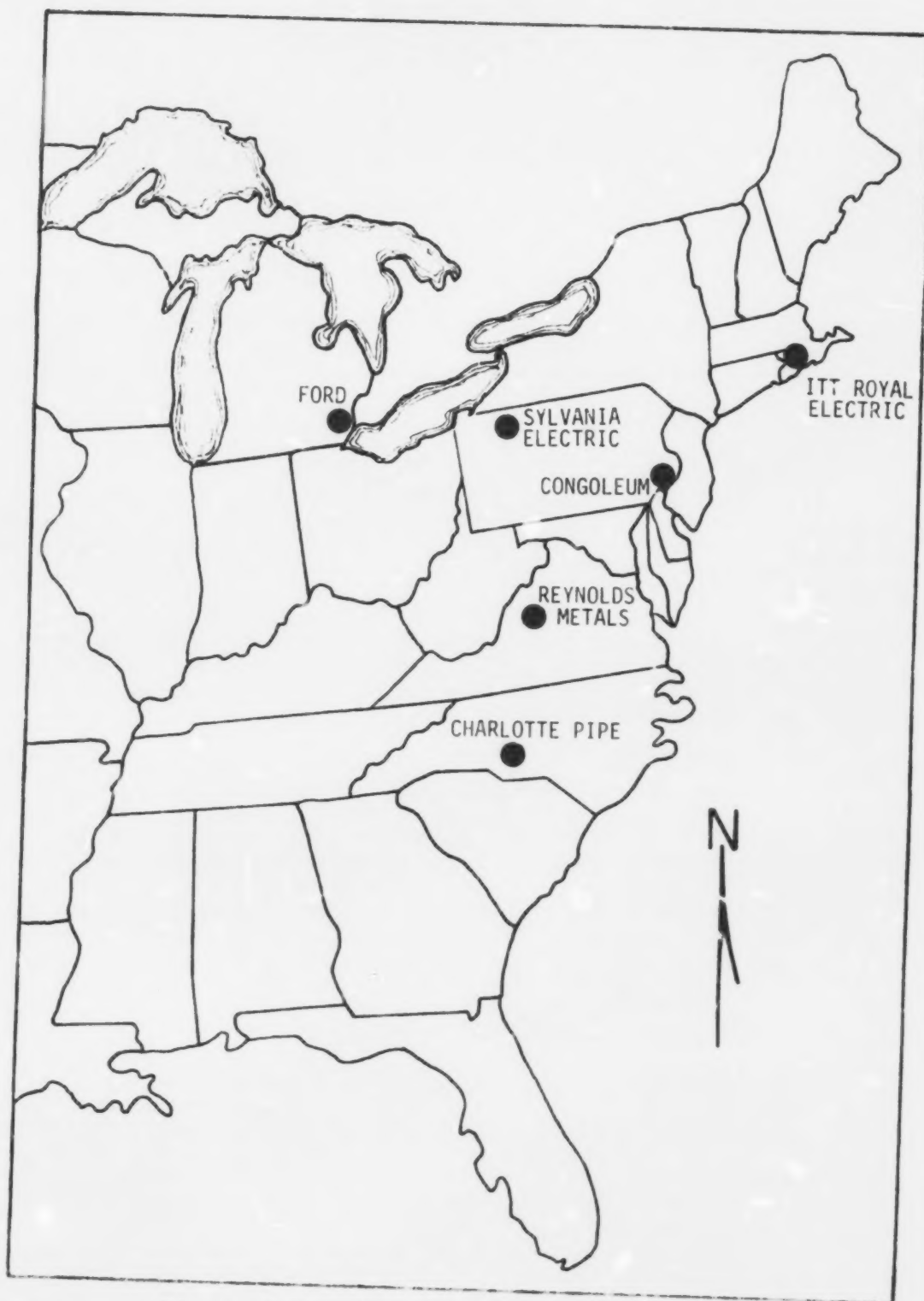


Figure 2-1. Map of sampling locations.

2.1 SPECIFIC MONITORING ACTIVITIES

Four sampling sites were selected at each plant location, considering prevailing wind conditions, proximity to the plant, availability of electric power and security. Whereever possible, sites were located on all four sides of the plant area. Each sampling site had one sampler with the exception of the site considered to be in the prevailing downwind direction. Two samplers were placed at the downwind site in order to achieve duplicate samples for the quality assurance program. Additionally, meteorological data were obtained from the nearest reliable source.

2.1.1 Ford Motor Company Vinyl Plant

Sampling in this area was conducted from February 12 to February 26, 1975. This polyvinyl chloride fabrication plant is located at the outskirts of the city of Mount Clemens, Michigan. Residential areas adjoin the plant property on three sides. The terrain is generally flat. Sampling sites were established as indicated in Figure 2-2. No site was located north of the plant since it was felt that organic solvents from the nearby Ford paint plant could interfere with analytical determinations. Descriptions of individual sampling sites are presented in Appendix A.

2.1.1.1 Meteorological Data - Meteorological data for this sampling period were obtained from the Selfridge Air National Guard Base located three miles east of the plant. These meteorological data are also presented in Figure 2-2 as

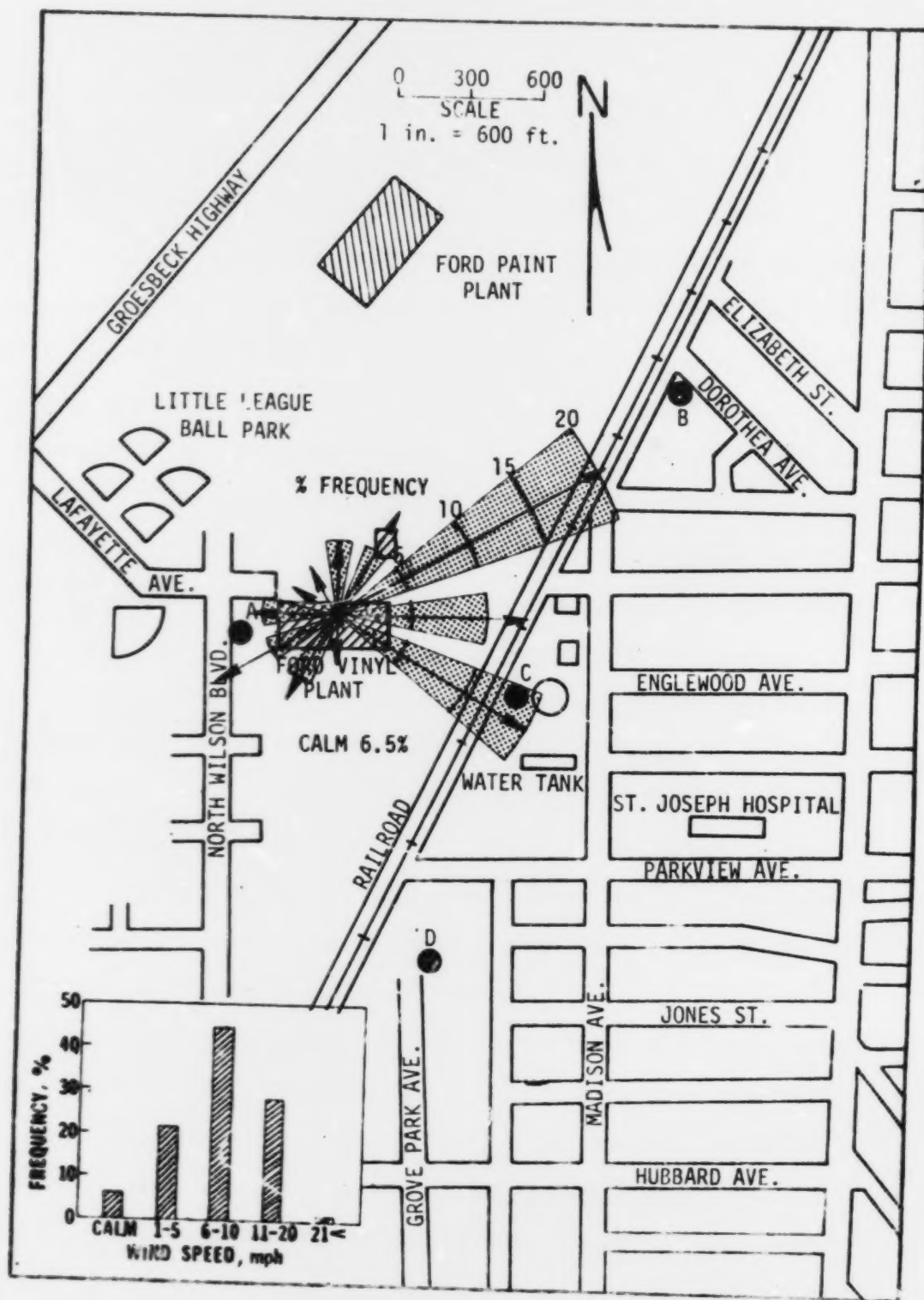


Figure 2-2. Sampling sites at Ford vinyl plant, Mt. Clemens, Michigan.

directional frequency components and wind speed frequencies. A complete meteorological data summary for the 14-day sampling period is presented in Appendix B.

2.1.1.2 Plant Operations - The Ford vinyl plant manufactures vinyl upholstery material for the automobile industry. Overall production during the 14-day sampling period was estimated at 35 percent of capacity.* During this time approximately 360,000 pounds of PVC plastics were used.

2.1.2 G.T.E. Sylvania, Inc.

Sampling in this area was conducted from February 15 to March 1, 1975. The Sylvania plant is located in the Industrial River front area at Warren, Pennsylvania. Industrial properties border the plant on two sides. The residential areas of the town lie to the northwest, north and northeast. The topography of the land is generally level from the bank of the Allegheny River to the edge of town where the elevation rises and the land becomes wooded. On the southwest side of the river wooded hills rise at the rivers edge. Sampling sites were established as indicated in Figure 2-3. All sites were at the same ground elevation as the plant except Site D which was approximately 50 feet higher. Descriptions of individual sampling sites are presented in Appendix A.

* Production rates are estimates obtained from plant management and are not based on official records.

2.1.2.1 Prevailing Meteorological Conditions - No reliable meteorological data were available for this sampling area. Observations by the field operator indicated that winds were generally in a northeasterly or southwesterly direction, as depicted in Figure 2-3.

2.1.2.2 Plant Operations - G.T.E. Sylvania, Inc., plant at Warren is a manufacturer of wire and cable products. This plant does not employ polyvinyl chloride plastic in its manufacturing process; thus it was used as a control study area. During the sampling period the plant was operating at 80 percent of capacity.*

2.1.3 Congoleum Industries

Sampling in this area was conducted from March 12 to March 26, 1975. The Congoleum Industries plant is located in Marcus Hook, Pennsylvania, which is one of the small but highly industrialized towns along the Delaware River south of Philadelphia. Industrial and residential properties are intermixed in this area. The topography of the land displays a gentle slope rising upward from the Delaware River a half mile southeast of the plant. Northwest of the plant the elevation increases until it forms a low ridge rising above the height of the plant buildings. To the northeast and southwest the elevation of the land varies little from that of the plant.

* Production rates are estimates obtained from plant management and are not based on official records.

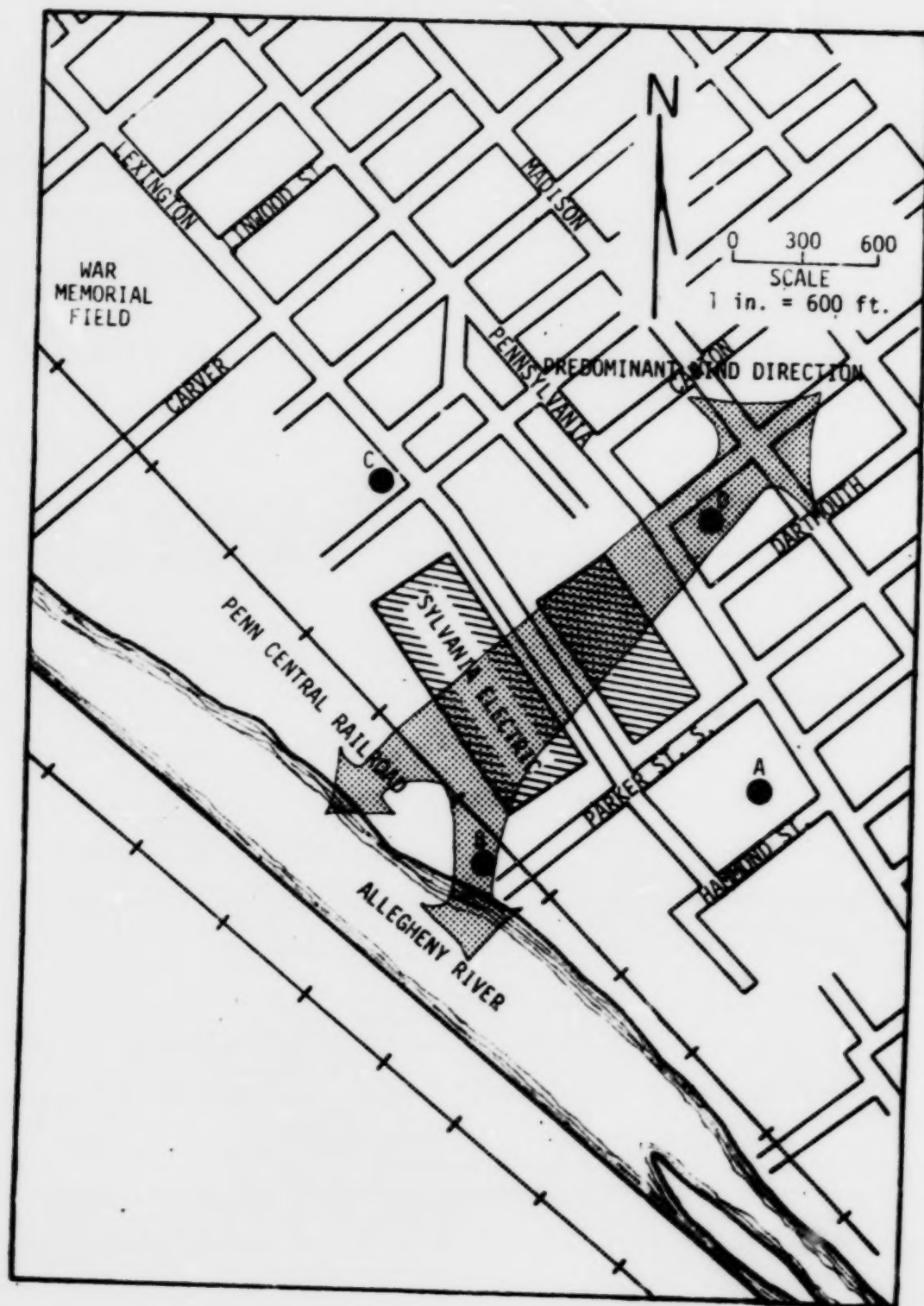


Figure 2-3. Sampling sites at G.T.E. Sylvania, Inc., Warren, Pennsylvania.

Two of the sampling sites, (A and B), as indicated in Figure 2-4, were located near company property. Sites C and D were located at a greater distance for security reasons. Descriptions of individual sampling sites are given in Appendix A.

2.1.3.1 Prevailing Meteorological Conditions - Meteorological data for the area were obtained from a system located at the main gate of the Sun Oil Company, one mile south of the Congoleum plant. These data are presented in Figure 2-4 as directional frequency components and wind speed frequencies for the sampling period. A complete summary of wind data for the sampling period is presented in Appendix B.

2.1.3.2 Plant Operations - The Congoleum plant at Marcus Hook is a manufacturer of flooring materials. The actual production weight of PVC was not provided by plant management. Overall production rates of the plant during the sampling period were estimated at 80 percent of capacity.*

2.1.4 Reynolds Metals Company

Sampling in this area was conducted from March 15 to March 29, 1975. The Reynolds Metals plant is located at the south edge of the town of Grottoes, Virginia. The topography of the land is generally flat to the south, north and east. To the west, a small hill rises from the bank of the

* Production rates are estimates obtained from plant management and are not based on official records.

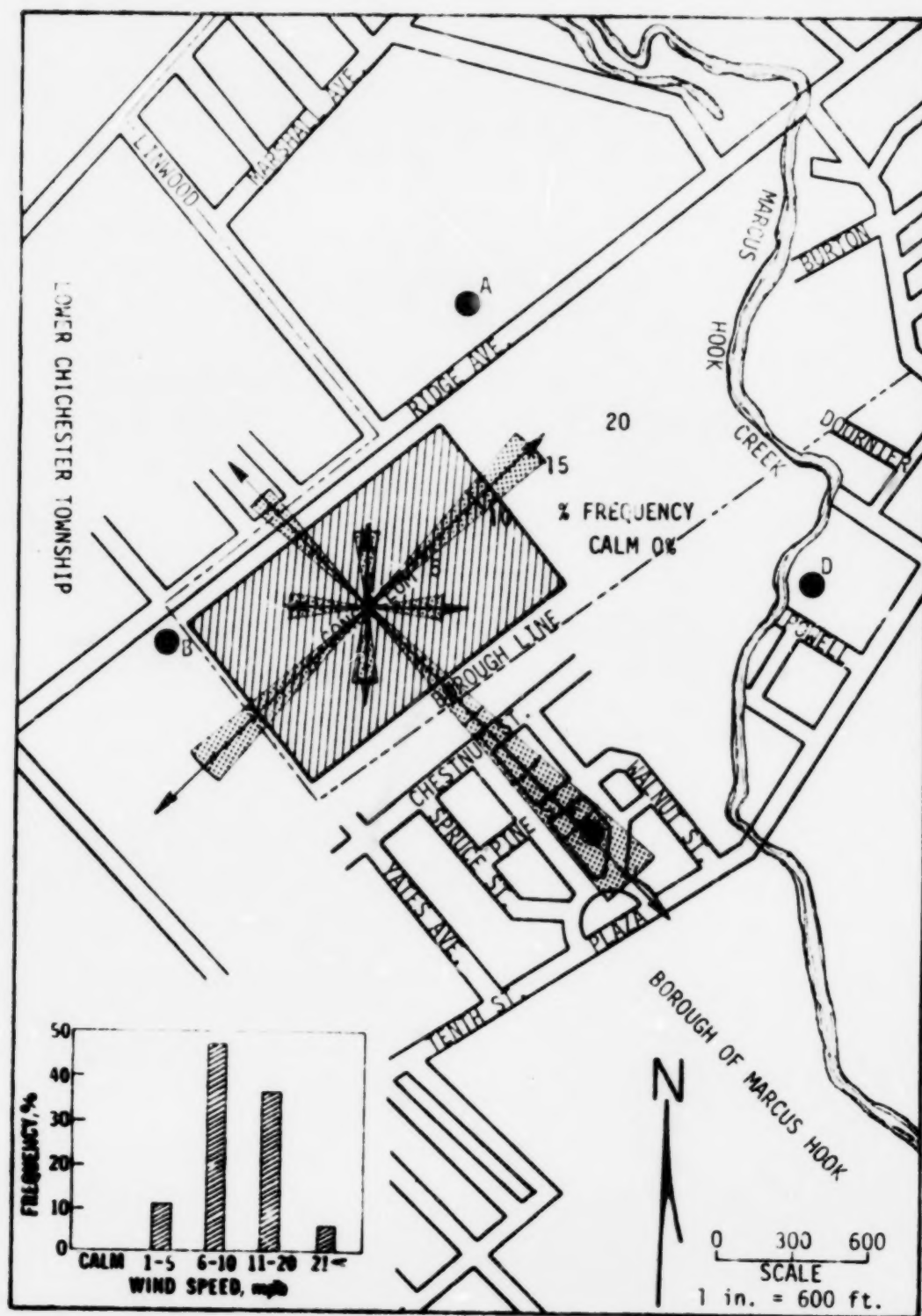


Figure 2-4. Sampling sites at Congoleum plant, Marcus Hook, Pennsylvania.

South River. Sampling sites, which are presented in Figure 2-5, were located as close to plant property as the availability of electrical power would permit. Descriptions of individual sampling sites are presented in Appendix A.

2.1.4.1 Prevailing Meteorological Conditions - Meteorological data for this area were obtained from the Shenandoah Valley Airport located three miles west of the plant. These data are also presented in Figure 2-5, as directional frequency components and wind speed frequencies for this sampling period. Since meteorological data were recorded from 5:00 a.m. to 10:00 p.m. each day, these data represent 75 percent of the sampling period. A complete summary of wind data for the 14-day sampling period is presented in Appendix B.

2.1.4.2 Plant Operations - The Reynolds Metals plant at Grottoes is a producer of plastic film for the packaging industry. Overall production for the sampling period was estimated at 40 percent of capacity.* During this time approximately 295,000 pounds of suspension polymerized PVC were used.

2.1.5 Charlotte Pipe and Foundry Co., Charlotte Plastics Division

Sampling in this area was conducted from April 10 to April 24, 1975. The Charlotte Plastics plant is located in a rural area four miles northwest of Monroe, North Carolina.

* Production rates are estimates obtained from plant management and are not based on official records.

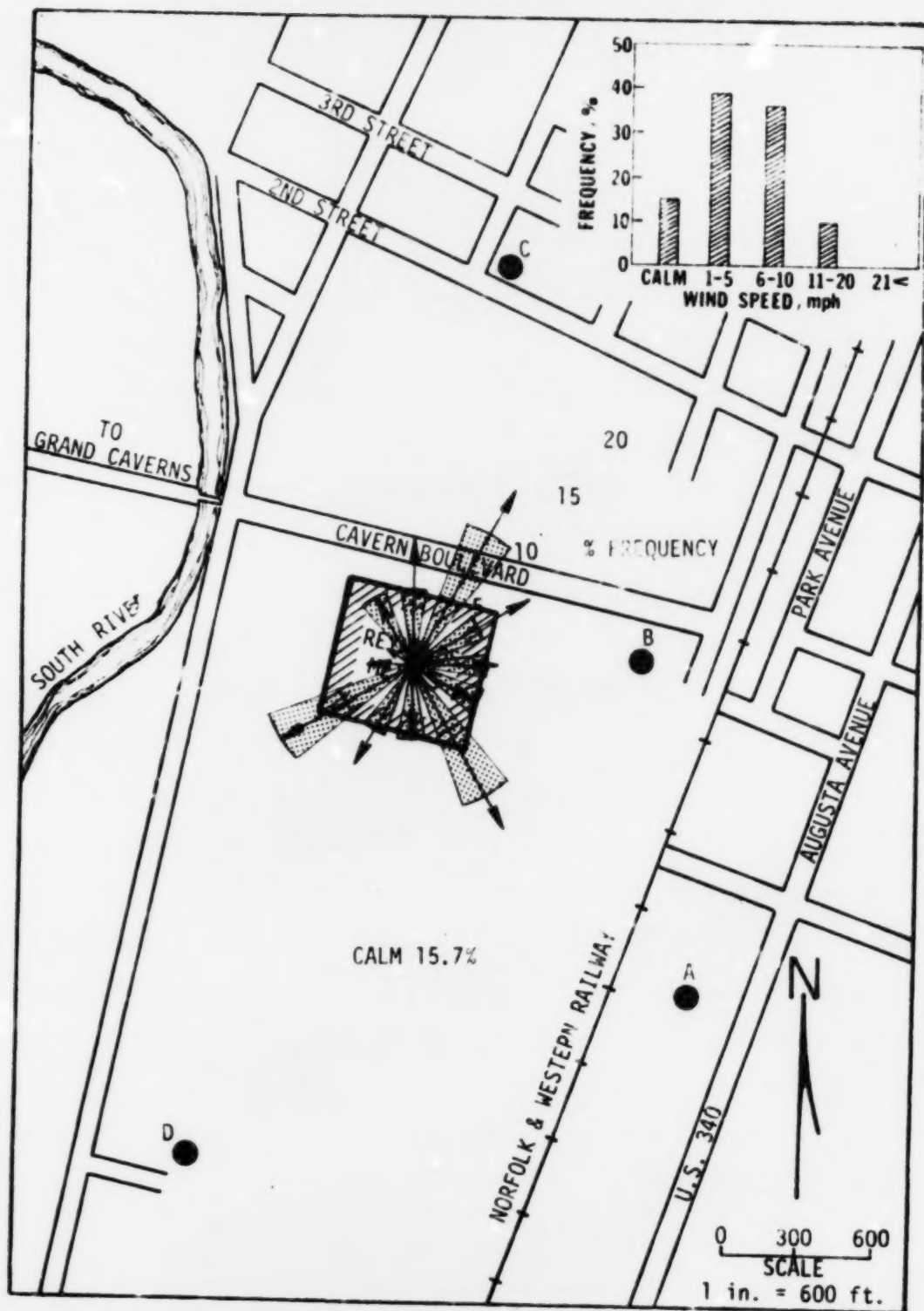


Figure 2-5. Sampling sites at Reynolds Metals plant, Grottoes, Virginia.

The topography of the area is flat with mixed wooded and open areas. The sampling sites, shown in Figure 2-6, were placed on all four sides of the plant at varying distances. The lack of electrical power made it necessary to locate Site B on company property. Descriptions of individual sampling sites are given in Appendix A.

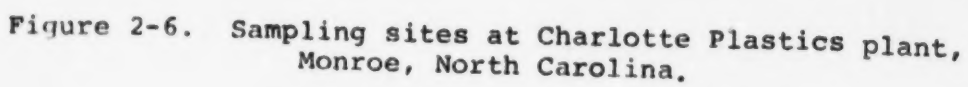
2.1.5.1 Prevailing Meteorological Conditions - Meteorological data for this area were obtained from Douglas Airport at Charlotte, North Carolina, which is twenty-five miles northwest of the sampling area. Due to the distance involved, care should be taken in interpretation of these data with respect to the sampling area. As before, data are presented in Figure 2-6 as directional frequency components and wind speed frequencies for the sampling period. A complete summary of wind data for the 14-day sampling period is presented in Appendix B.

2.1.5.2 Plant Operations - The Charlotte Plastics plant at Monroe is a fabricator of plastic pipe and fittings. During the sampling period approximately two million pounds of PVC were used in production operations.* The polymerization process of the PVC employed was not provided by plant management.

2.1.6 ITT, Royal Electric, Division

Sampling in this area was conducted from May 22 to June 5, 1975. The Royal Electric plant is located in the north-

* Production rates are estimates obtained from plant management and are not based on official records.



east section of Pawtucket, Rhode Island. Residential areas lie on three sides of the plant. Adjacent to the west side of the plant is a small industrial property. The topography of the land is generally level. The sampling sites, shown in Figure 2-7, were located on all four sides of the plant. Descriptions of individual sampling sites are presented in Appendix A.

2.1.6.1 Prevailing Meteorological Conditions - Meteorological data for this area were obtained from the Rhode Island Department of Health Air Pollution Station at Providence, located five miles southwest of the sampling area. These data are presented in Figure 2-7 as directional frequency components and wind speed frequencies for the sampling period. A complete summary of meteorological data for the 14-day sampling period is presented in Appendix B.

2.1.6.2 Plant Operations - The Royal Electric plant is a manufacturer of rubber and vinyl-coated wire and cable. During the sampling period approximately 176,000 pounds of PVC were used in production operations.* The polymerization process of the PVC employed was not provided by plant management.

* Production rates are estimates obtained from plant management and are not based on official records.

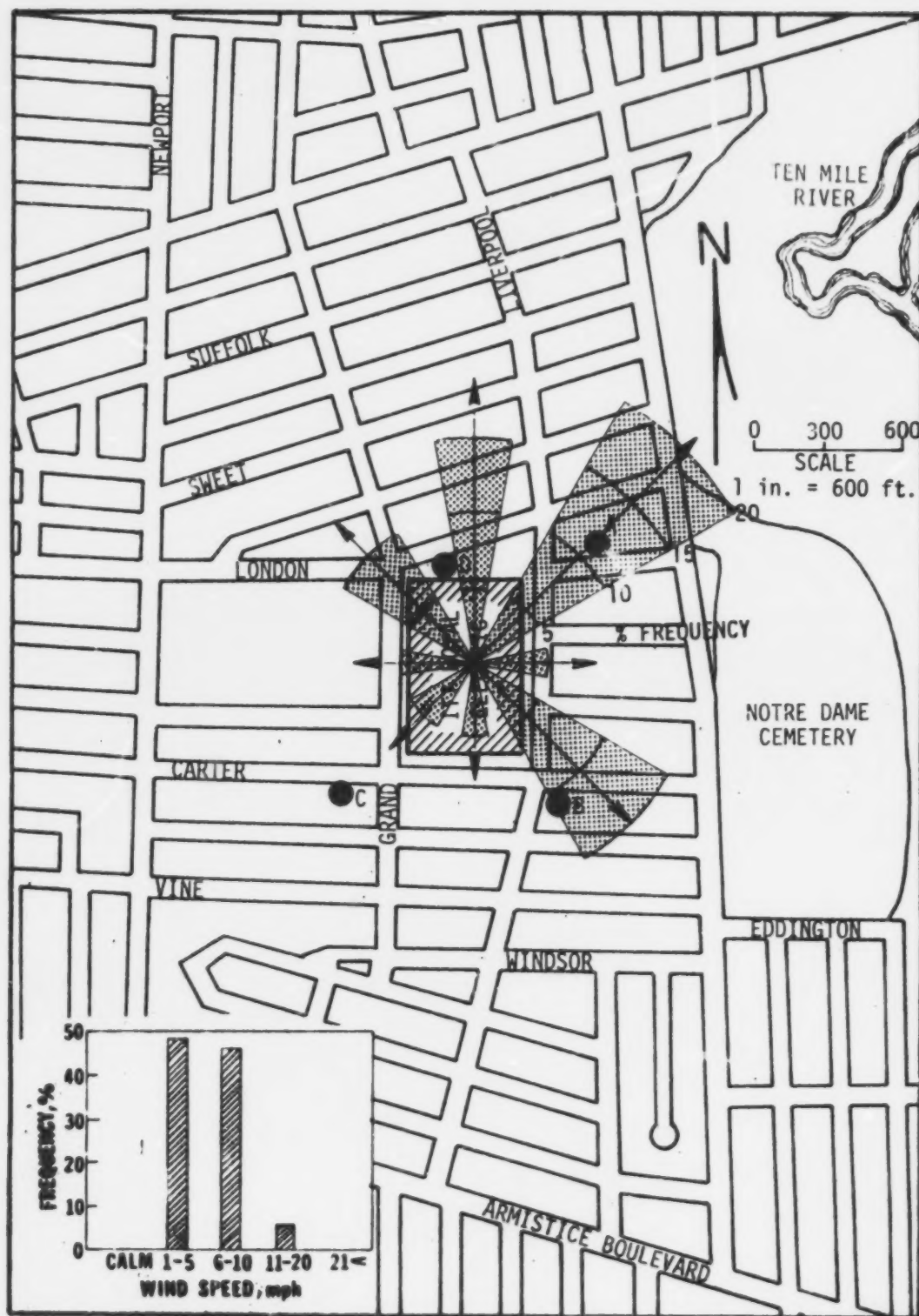


Figure 2-7. Sampling sites at Royal Electric plant, Pawtucket, Rhode Island.

3.0 SAMPLING AND ANALYTICAL TECHNIQUES

3.1 SAMPLING EQUIPMENT

Vinyl chloride sampling was conducted with a specially designed sampler as shown in Figure 3-1. A vacuum pump (1) was used to maintain a vacuum greater than 0.5 atmosphere, measured by a vacuum gage (2). A critical orifice (3), consisting of a 3/4-inch twenty-seven gage hypodermic needle, controlled the sample air flow at approximately 200 ml/min. An adsorption tube (4), consisting of a borosilicate glass tube (18 in. long and 10 mm O.D.) filled with activated charcoal, provided the collection medium. This tube was connected to the vacuum source by an appropriate fitting. A rotometer, calibrated at 25°C and 760 mm Hg with a positive-displacement-type calibrator, (traceable to an NBS standard), was used to measure the sampling rate before and after each 24-hour sampling period. A tubular shield (5) was provided to protect the absorption tube from light and rain during sampling. The sampler was normally mounted on a wooden stand with the sampler inlet five feet above the ground. This sampling configuration incorporated all operational parameters as recommended in the U.S. Environmental Protection Agency publication "Tentative Methods for Determination of Vinyl Chloride in the Atmosphere." This method is presented in Appendix C.

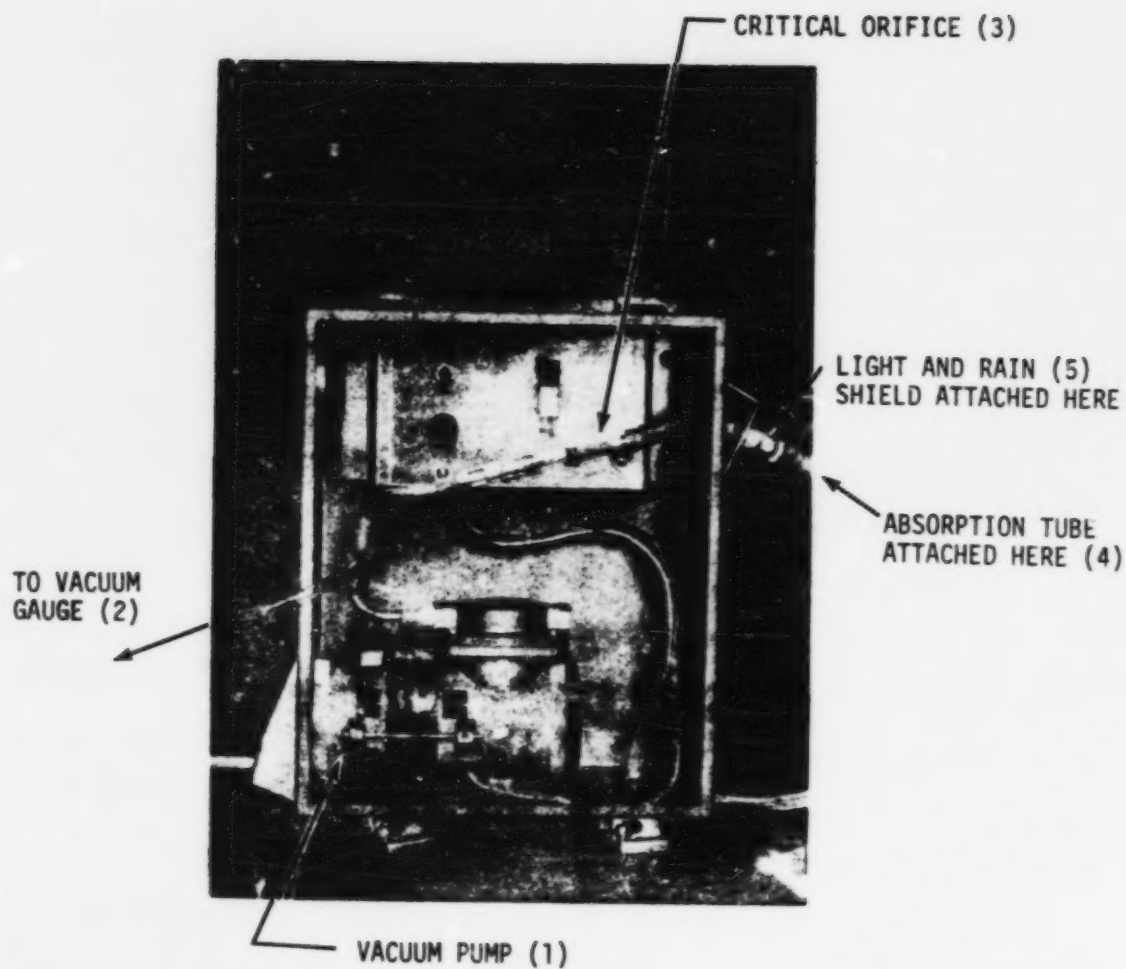


Figure 3-1. Custom-built vinyl chloride sampler.

3.2 FIELD OPERATIONS

For each survey, a local field operator was instructed in operating the sampling devices as described in the Operators Guide, see Appendix D.

In order to standardize all field operations, the operators would visit the sites at the same time each day, starting at Site A and ending at Site D. This permitted sampling time at each site to be as near to 24 hours as possible. After installing a new adsorption tube, the vacuum gage reading, tube number, flow rate and exact time were recorded. At the end of each sampling period and prior to removing the adsorption tube, these readings were again recorded. The exposed adsorption tubes were capped and stored in a light tight container. Every other day the 10 exposed adsorption tubes were shipped in special padded boxes via air mail to the PEDCo-Environmental laboratory for analysis.

3.2.1 Meteorological Measurements

Meteorological data at each sampling area were obtained from the nearest reliable source. As noted, the only exception was at Warren, Pennsylvania, where visual observations made by the field operator were used. Since these measurements were generally not made in the immediate vicinity of the sampling area, care should be taken in relating them to measured vinyl chloride levels.

3.3 ANALYTICAL PROCEDURES

All standards were prepared using the procedure recommended by the National Institute of Occupational Safety and Health method P&CAM 127. Analytical procedures followed the U.S. Environmental Protection Agency's "Tentative Method for the Determination of Vinyl Chloride in the Atmosphere by 24-Hour Integrated Sampling" (Appendix C).

3.3.1 Preparation of Standards

Vinyl chloride standards were prepared by dissolving 99.9 percent vinyl chloride gas in spectrophotometric grade carbon disulfide. Initially, five milliliters of carbon disulfide were pipetted into two tared vials fitted with teflon valve caps. The vials were then weighed to the nearest milligram and the liquid volume of carbon disulfide determined from its weight and specific gravity.

A 100 ml gas sampling bulb was flushed and filled with vinyl chloride gas. The bulb was allowed to equilibrate to room temperature and pressure. A 250 microliter aliquot was withdrawn, using a gas tight syringe, and injected into one of the vials containing carbon disulfide. This solution was used as a master stock.

Fifty microliters of the master stock solution was injected into a second vial containing a known volume of carbon disulfide. The concentration of vinyl chloride in this solution was calculated and used as a working standard.

Initially, standards were prepared in the range of 0.001 μg VC/microliter of solution. Since these tended to degrade rapidly, standards were intentionally prepared at lower concentrations (≈ 0.0003 μg /microliter solution). New standards were prepared, as previously described, for each set of analysis. These were compared to the original low-level standard and no significant change was observed in the concentration of the original low-level standard during the four month period of this study. This low-level standard was stored at 0°C in a teflon sealed vial when not in use.

3.3.2 Desorption of Vinyl Chloride from Charcoal

Twenty-five ml graduated cylinders, fitted with ground glass stoppers, were used as the desorption vessels. Twenty-five milliliters of carbon disulfide were pipetted into a cylinder, which was then stoppered and cooled to 0°C in a refrigerated bath. An exposed charcoal adsorption tube was opened, the glass wool plug removed from one end, and the contents shaken as rapidly as possible into the cylinder, which was restoppered and swirled in the ice bath to remove the heat of reaction (from the charcoal contacting the solvent). This process was repeated for the rest of the sample tubes. The cylinders were left in the bath for one hour to desorb the vinyl chloride from the charcoal.

After one hour the tubes were removed, agitated, and a portion transferred to a vial and sealed with a teflon-

lined septum. This aliquot of the sample was then used for analysis.

3.3.3 Analytical Method

A 2.5 m glass column, filled with 0.4 percent carbowax 1500 on carbopak A, was used with a Perkin Elmer model 990 gas chromatograph equipped with a flame ionization detector. Helium was used as carrier gas, inlet pressure 60 psig, flow rate 73 ml per minute. Detector temperature and injection block temperature were maintained at 150°C. Column temperature was maintained at 70°C and was operated isothermally. Approximately 3 microliters of sample were injected for analysis. Figure 3-2 illustrates the resulting chromatogram typically obtained.

3.3.4 Adsorption-Desorption Efficiency

Blank adsorption tubes were connected to a vacuum pump using a critical orifice to regulate flow. A glass "T" was connected to the other end of the adsorption tube and one end of the glass "T" was sealed with a septum, which was used for sample injection. Another blank adsorption tube was fitted to the other end of the "T" and served as a scrubber for the room air being drawn into the tube.

A gas sampling bulb was filled with vinyl chloride gas and a 100 microliter sample of the gas was then injected slowly into the adsorption tube through the septum. Air flow was continued through the tube for 10 minutes. The

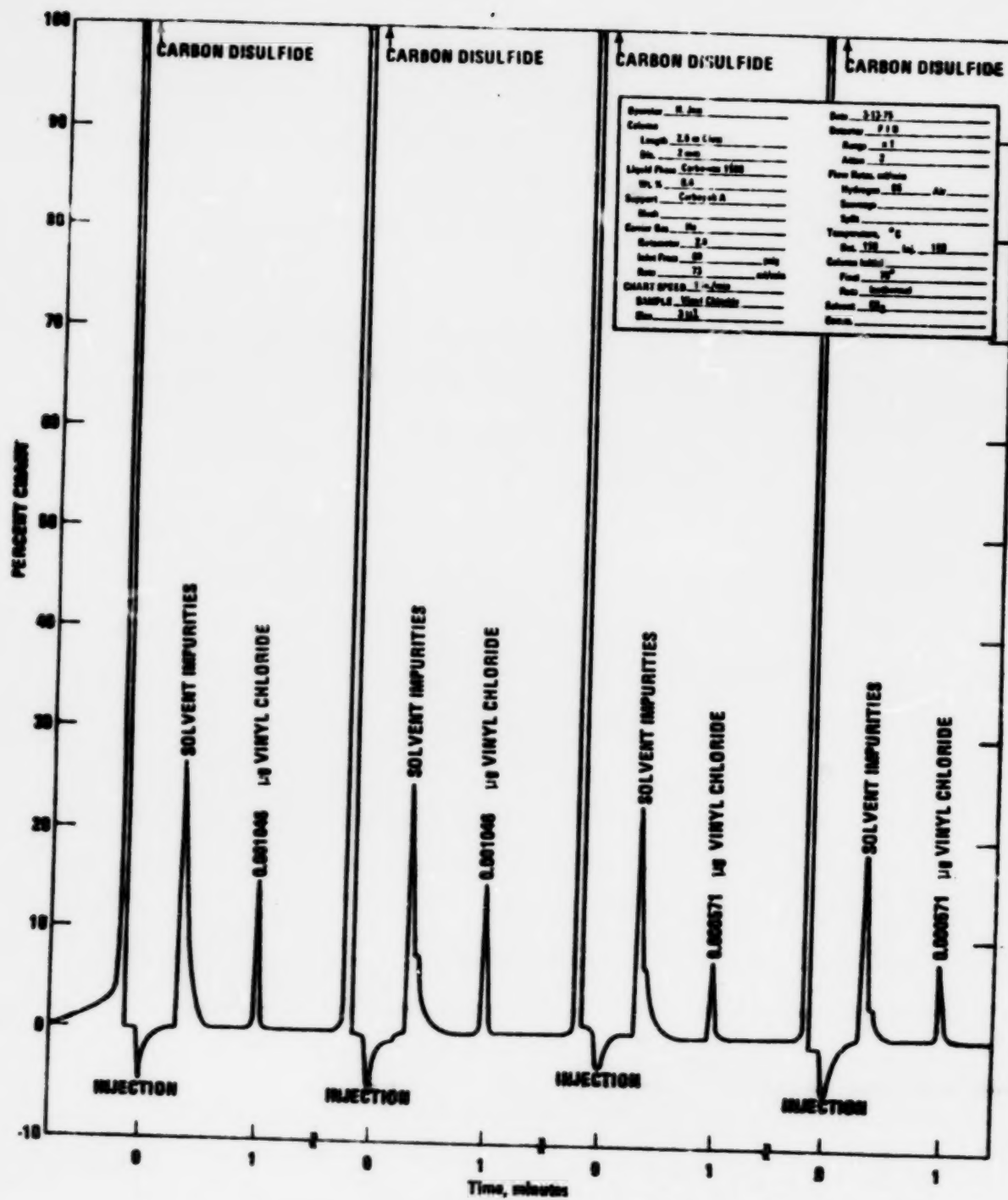


Figure 3-2. Chromatogram for the determination of vinyl chloride.

tubes were then disconnected and allowed to equilibrate for 24 hours. They were then desorbed by the same procedure as described in Section 3.3.2, analyzed with the gas chromatographic technique as described in Section 3.3.3, and the desorption efficiency calculated from the amount of vinyl chloride injected versus the amount recovered. The overall desorption efficiency for twenty-eight samples was determined to be 89 percent. The results of this study are graphically displayed in Figure 3-3.

3.4 QUALITY ASSURANCE PROGRAM

In order to assure the validity of data generated during the course of this project, a rigorous quality assurance program was maintained in order to support the data and also to point out any errors during analysis.

3.4.1 NBS Vinyl Chloride Reference Samples

Charcoal adsorption tubes, identical to those used for the collection of samples, were prepared by the National Bureau of Standards and supplied to PEDCo-Environmental by the Project Officer for quality control checks. These tubes had been spiked with vinyl chloride, in the range of 12 to 60 μg . Using exactly the same desorption procedure as described in Section 3.3.2, randomly selected quality control samples were analyzed along with each batch of samples and the results compared to the values provided by the National Bureau of Standards. Figures 3-4 and

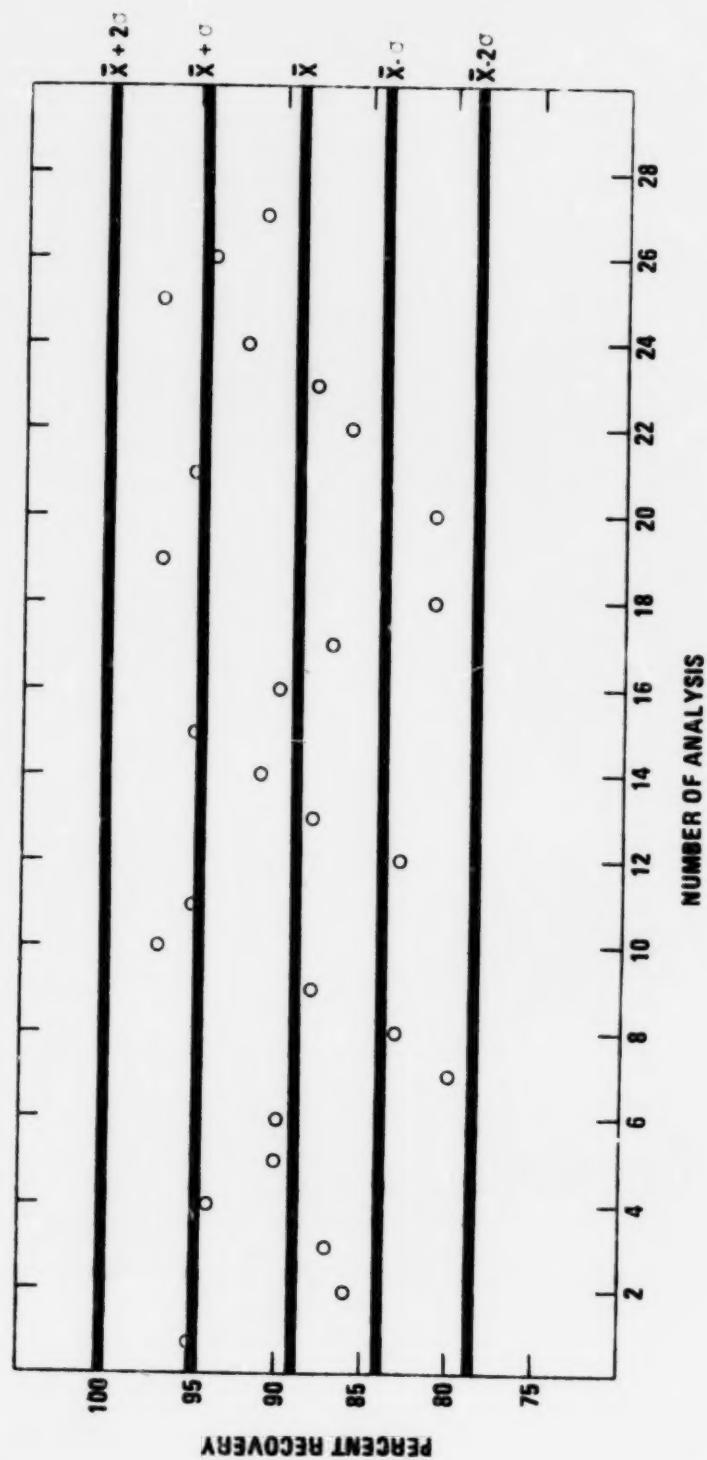


Figure 3-3. Vinyl chloride desorption efficiency from activated charcoal.

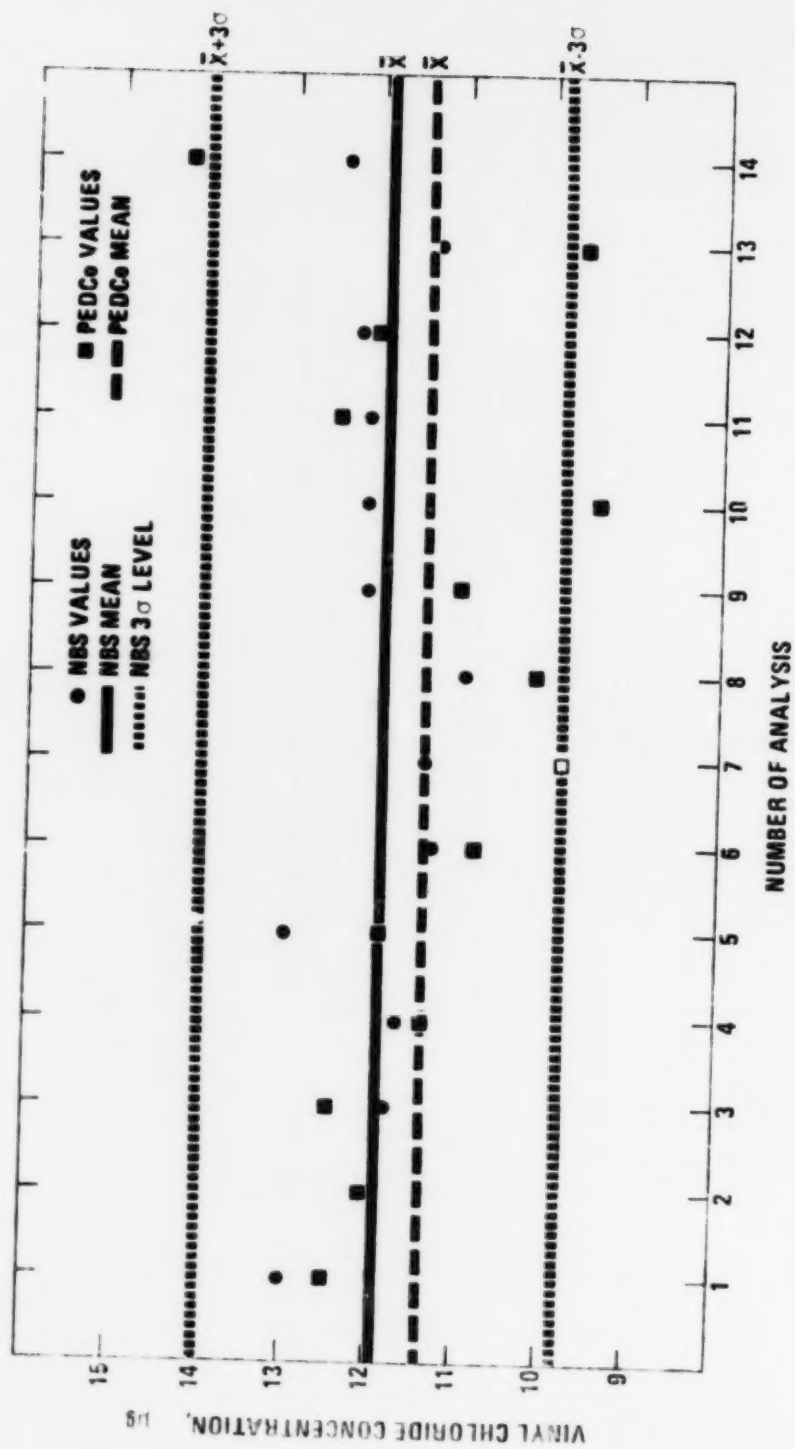


Figure 3-4. Comparison of low-level vinyl chloride quality control data.

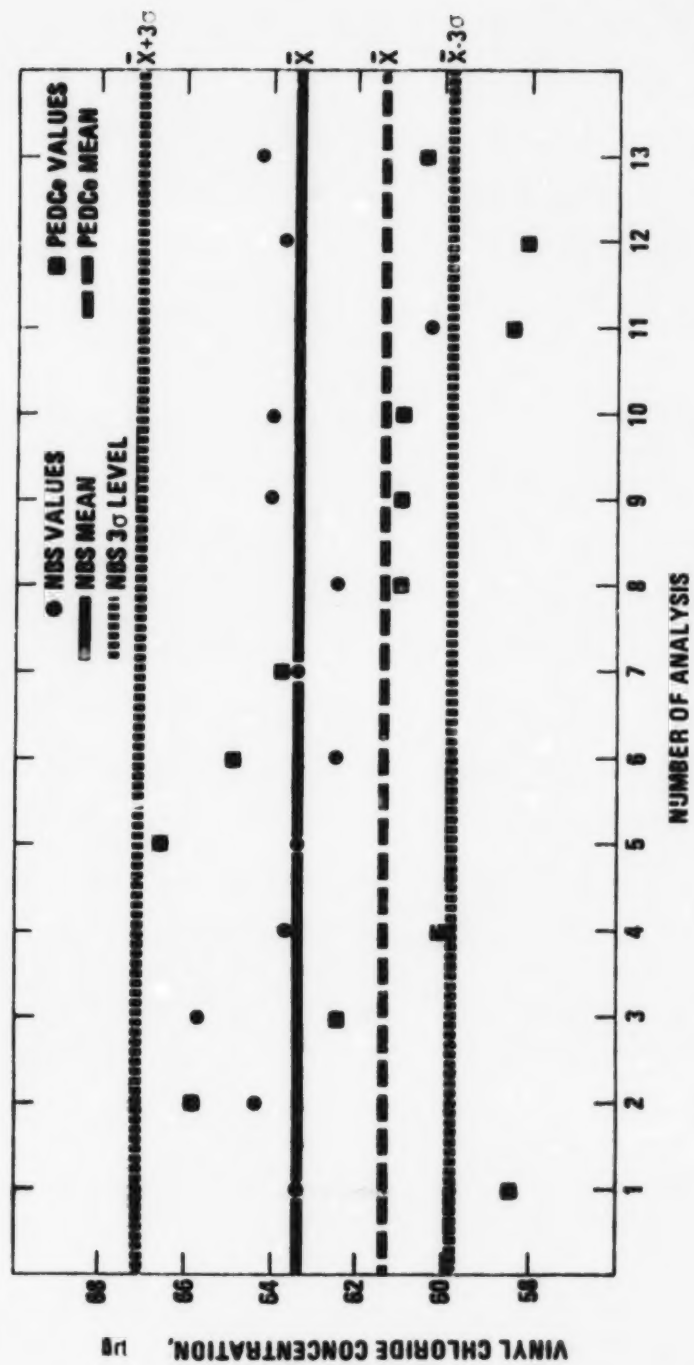


Figure 3-5. Comparisons of high-level vinyl chloride quality control data.

illustrate these comparisons. In the 12 μg range, the average value determined by the PEDCo laboratory on 14 samples was 11.4 μg versus 11.9 μg reported by NBS. This results in an average difference of 4.4 percent. In the 60 μg range, the average value determined by PEDCo on 13 samples was 61.4 μg versus 63.4 μg reported by NBS, an average difference of 2.0 μg or 3.2 percent.

3.4.2 Split Samples

Another phase of our Quality Assurance Program involved the use of duplicate samples. One of the sites in each survey had two samplers operating simultaneously. One of the samples was analyzed by the PEDCo laboratory. For those samples on which vinyl chloride was detected, the duplicate was sent to the Project Officer for analysis by an independent laboratory. Table 3-1 shows the results of nine sets of duplicate tubes analyzed by PEDCo and the independent laboratory. The average difference between laboratories was $0.9 \pm 0.6 \mu\text{g}$. The values indicated by an asterisk were not included in the statistical evaluation since the "Q-test" of Dean and Dixon, for the rejection of an observation, showed that at the 90 percent confidence level the observed difference was found to exceed the expected range of differences. Therefore, this set of values was rejected.

3.4.3 Calibrating Hypodermic Needles

An additional phase of the Quality Assurance Program was checking the flow rate of the critical orifices employed

Table 3-1. PAIRED SAMPLE ANALYSIS

Micrograms vinyl chloride determined	
PEDCo	Independent laboratory
3.4	2.6
2.2	2.5
5.6	6.4
2.5	3.9
4.1	3.7
1.0	3.5
1.8*	6.7*
1.2	2.3
0.75	0.64

* Values not included in statistical evaluation.

in the sampling equipment (a 3/4-inch, 27 gage hypodermic needle was used as the critical orifice in the sampler). The flow rate through each needle was determined by the PEDCo laboratory using a soap bubble meter. Six needles were chosen at random and given to the Project Officer. Flow rates were determined by the EPA and these values were compared to those originally determined by PEDCo. The results are tabulated in Table 3-2. Both values are corrected to 760 mm Hg and 25°C. The average difference, based on an average flow rate of 200 cc/min, is 1.5 percent

Table 3-2. COMPARISON OF CRITICAL ORIFICE FLOW RATE

Needle No.	Laboratory*	
	PEDCo	EPA
1	206	209
2	210	213
3	207	210
4	202	206
5	195	197
6	174	178

* All measurements reported as cc/min corrected to 25°C and 760 mm Hg.

4.0 RESULTS AND CONCLUSIONS

Vinyl chloride levels detected in the vicinity of polyvinyl chloride fabrication plants were generally found to be in the range of <0.5 ppb to 5 ppb for a 24-hour integrated average. These are relatively low levels. The maximum vinyl chloride level for any single 24-hour period was 7 ppb for a 24-hour integrated average. In the six study areas vinyl chloride was detected at three of them, and these are subsequently discussed. Sampling at the G.T.E. Sylvania, Inc. plant, which was a "background" location within a highly industrialized area, at the Charlotte Plastics plant and at the Royal Electric Plant, produced levels below the detection limit of 0.5 ppb. A summary of all measurement data is presented in Appendix E.

4.1 MAXIMUM DETECTED LEVELS

4.1.1 Ford Motor Company Vinyl Plant

Figure 2-2, as previously presented, depicts the sampling sites and the predominate meteorological conditions which prevailed throughout the sampling period. During most of the sampling period, vinyl chloride was not detected. However, one sampling day in particular should be given special consideration. On February 19, 1975 the highest value for the sampling period was observed. Meteorological

conditions for this sampling day are presented in Figure 4-1. The winds were predominately from the southwest at 6 to 20 miles/hr. A vinyl chloride concentration of 7 ppb for a 24-hour integrated average was observed at sampling site B which is downwind of the plant. No logical explanation exists for this high level since the winds throughout the sampling period were generally from the same direction.

4.1.2 Congoleum Industries

During the first six days of the sampling period, from March 12 to March 17, vinyl chloride was twice detected in the range of 1 ppb. From March 18 through March 25 vinyl chloride was detected in every twenty-four hour sampling period. The general meteorological conditions, as shown in Figure 4-2, did not differ significantly from those occurring during the entire sampling period (See Figure 2-4).

In general, measurements of vinyl chloride at Sites A, C and B which were at the greatest distance from the plant showed levels in the 1 to 3 ppb range. Site A, which was 100 feet from the plant, displayed higher levels in the range of 3 to 4 ppb.

4.1.3 Reynolds Metals Company

During seven days in the middle of the sampling period (March 19 to March 25), vinyl chloride levels were detected during each twenty-four hour period. The levels were consistently in the 1 to 2 ppb range for each site. The

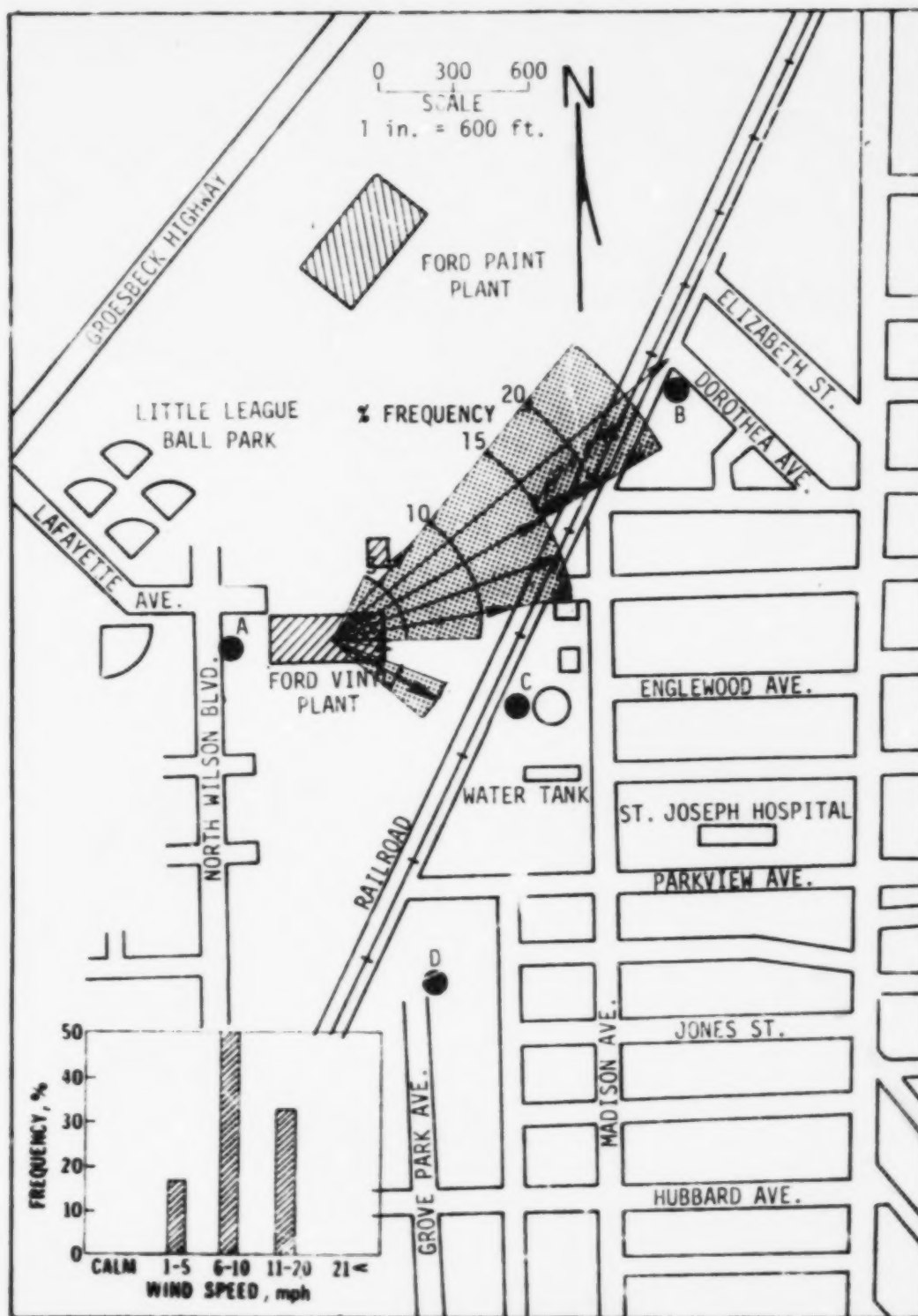


Figure 4-1. Meteorological data at the Ford vinyl plant for February 19, 1975, Warren, Michigan.

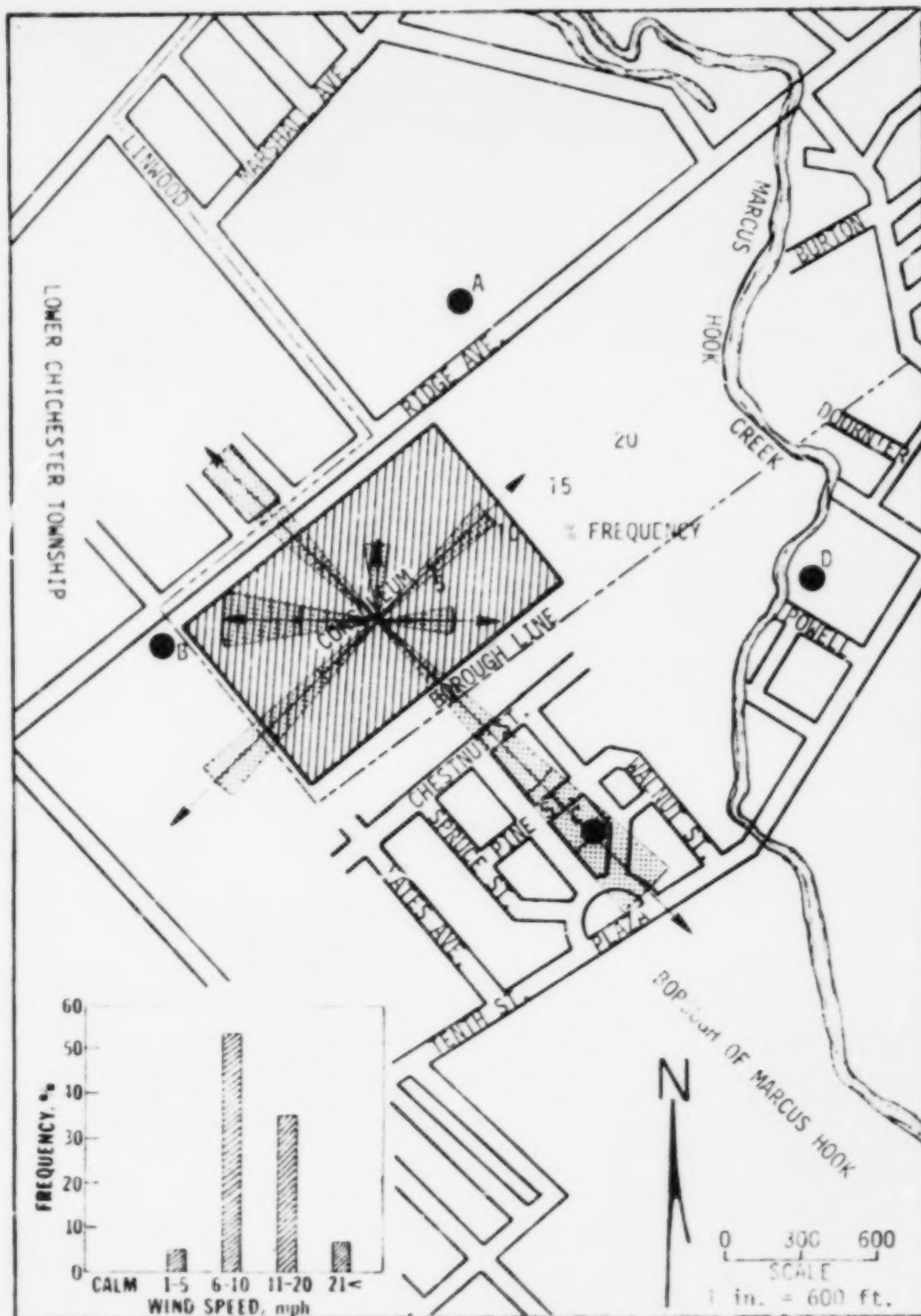


Figure 4-2. Meteorological data for the period March 15 through March 25, 1975 at the Congoleum plant, Marcus Hook, Pennsylvania.

meteorological conditions which prevailed during this period are presented in Figure 4-3.

4.2 CONCLUSIONS

This study demonstrates that very low concentrations of vinyl chloride occasionally exist in the ambient air in the vicinity of some polyvinyl chloride fabrication plants. Concentrations found varied from less than 0.5 ppb to approximately 5 ppb for a 24-hour integrated average.

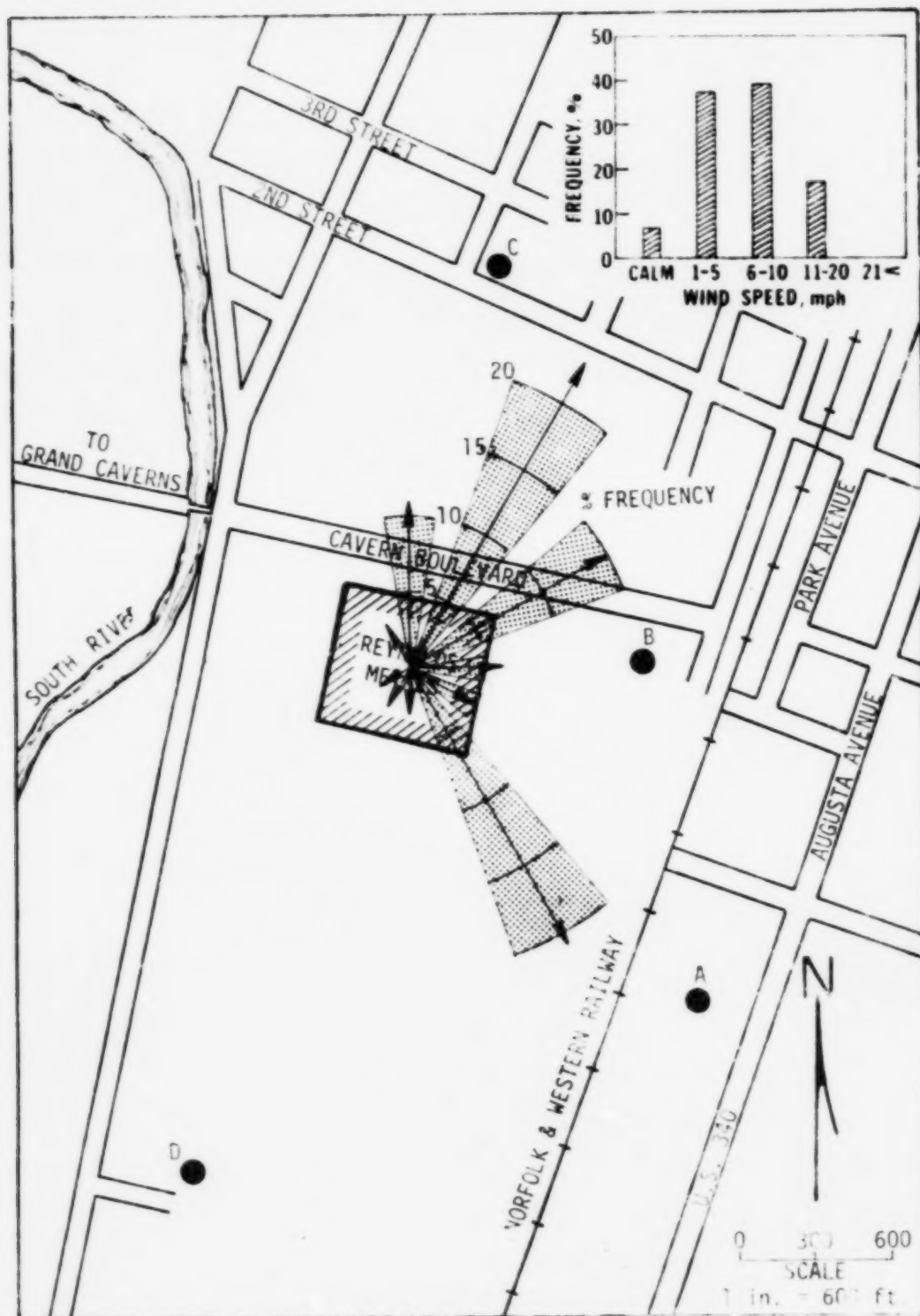


Figure 4-3. Meteorological data for the period March 19 1948 to March 25 at the Reynolds Metals Company, Winston-Salem, N.C.

APPENDIX A
SAMPLING SITE DESCRIPTION

Location of Vinyl Chloride Study Sites

Ford Motor Company (vinyl plant)
151 Lafayette Avenue
Mt. Clemens, Michigan

Site A

Location Residence of Mr. Ray Jolly
 230 North Wilson Boulevard
 Mt. Clemens, Michigan

This site was located in the backyard of the Jolly residence and was 100 feet west of plant property. The monitor was mounted on a power pole five feet above the ground.

Site B

Location Residence of Mr. Dimitri Strilany
 51 Dorothea Street
 Mt. Clemens, Michigan

This site was located in the backyard of the Strilany residence about 1400 feet northeast of the vinyl plant. The area between the plant and this sampling site was flat and grassy with no obstructions. The monitor was mounted on a power pole five feet above the ground.

Site C

Location Madison Water Tower

Contact Mr. Spencer Fenton
 Superintendent of Streets and Parks
 145 Hubbard Street
 Mt. Clemens, Michigan

This site was located on a piece of property which is owned by the City of Mt. Clemens and on which a large water tower is located. The monitors were about 600 feet east-southeast of the vinyl plant and 200 feet from plant property. There were two monitors at this site located four feet apart and five feet above the ground.

Site D

Location Residence of Mr. Francis Presley
 112 Grove Park
 Mt. Clemens, Michigan

This site was located in the front yard of the Presley residence about 1200 feet south of the vinyl plant. The monitor was mounted on a stand five feet above the ground.

Location of Vinyl Chloride Study Sites

G.T.E. Sylvania, Inc.
12 - 2nd Avenue
Warren, Pennsylvania

Site A

Location State Forestry Office
 50 Hammond Street
 Warren, Pennsylvania

Owner Intervestment Corp.
Contact Mr. G. Ensworth (Sec.-Treas.)
 Phone 814-726-1910

This site was located near the maintenance building of the State Forestry Office about 1000 feet east of the Sylvania plant. There were two monitors at this site mounted on a wooden stand five feet above the ground.

Site B

Location Riverside Acid and Inhibitor Co.
 South Parker Street
 Warren, Pennsylvania

Contact Mr. Robert Bonadio

This site was located near a small one-story building belonging to the Riverside Acid Co. The monitor was mounted five feet above the ground on a wooden stand. This site was about 500 feet south of the plant.

Site C

Location Barnhart Davis Co.
 702 Lexington Avenue
 Warren, Pennsylvania 16365

Contact Mr. William Bank (Treas.)

This site was located on a flat roof of a small building. The roof was 14 feet above the ground and the monitor was mounted on a wooden stand five feet above the roof. This site was about 500 feet northwest of the plant.

Site D

Location Residence of Mr. L. Burdick
 10 Central Avenue
 Warren, Pennsylvania

This site was located in the backyard of the Burdick residence about 1000 feet northeast of the plant. The monitor was mounted five feet above the ground on a wooden stand. The ground level at this location is about 50 feet higher than ground level at the plant.

Location of Vinyl Chloride Study Sites

Congoleum Industries
Ridge Road
Marcus Hook, Pa.

Site A

Location Cox Trailer Park
 4300 West 9th Street
 Trainer, Pa.

This site was located in the fenced-in swimming pool area of the Cox Trailer Park 600 feet north of the nearest plant building. The sampler was mounted on a wooden stand five feet above the ground and at the same elevation as the plant roof.

Site B

Location Residence of Mr. Daniel Bonaventure
 169 Ridge Road
 Linwood, Pa.

This site was located in the backyard of the Bonaventure residence 100 feet southwest of the nearest plant building. The sampler was mounted on a wooden stand five feet above the ground.

Site C

Location Residence of Mr. Jackie West
 5 Ceader Street
 Marcus Hook, Pa.

This site was situated between two rows of houses which run parallel in the direction of the plant. It was located in the backyard of the West residence 900 feet southeast of the nearest plant building. The sampler was mounted on a wooden stand five feet above the ground.

Site D

Location Residence of Mr. Jack Elliot
 4336 Post Road
 Trainer, Pa.

This site was located in a grassy area behind the Elliott's garage 1200 feet east of the nearest plant building. According to local information this site was considered to be in the prevailing wind direction for this time of year; therefore, two monitors were located at this site. The samplers were mounted on a wooden stand five feet above ground and four feet apart.

Location of Vinyl Chloride Study Sites

Reynolds Metals Company
Packaging Division-Plastics
Grottoes, Va. 24441

Site A

Location Residence of Mr. H. F. Rankin
 Rt. #1
 Grottoes, Va.

This site was located in the rear yard of the Rankin residence which is on a rise that is the same height as the plant roof. The sampler was mounted on a wooden stand five feet above the ground and 1400 feet southeast of the plant. There were no obstructions between this site and the plant.

Site B

Location Residence of Mr. Douglas Good
 Cavern Boulevard
 Grottoes, Va.

This site was located in the backyard of the Good residence. The elevation was about 30 feet higher than the plant property and was located 700 feet east of the plant and adjoining the plant property. Two monitors were established at this location. The samplers were mounted on a wooden stand five feet above the ground and four feet apart.

Site C

Location Residence of Mr. William Davies
 2nd and Cherry
 Grottoes, Va.

This site was located in the front yard of the Davies residence 1200 feet northeast of the plant. There was a small wooded area owned by the Reynolds Metals Co. between this site and the plant. The site location however was elevated such that the plant roof could be seen over the trees. It was felt that the woods would offer little or no interference with sampling. The sampler was mounted on a wooden stand five feet above the ground.

Site D

Location W. E. Wilkerson's South River Dairy Farm
 Grottoes, Va.

Owner W. E. Wilkerson
Box 127
Grottoes, Va.

This site was located near a barn on the Wilkerson's South River Dairy Farm. The barn was located 2000 feet southwest of the plant in the center of a large field. Most of the land between the plant and this site is owned by the Reynolds Metals Company. The land is flat and there are no trees or obstructions between the plant and the site. Although the distance to this site was greater than that preferred, no other location was available in this area. The sampler was mounted on a wooden stand placed atop a pile of dirt. The sampler inlet was 10 feet above the surrounding ground.

Location of Vinyl Chloride Study Sites

Charlotte Plastics (A division of Charlotte Pipe and
P. O. Box 1220 Foundry Company)
Monroe, North Carolina 28110

Site A

Location Residence of Mr. Benjamin E. Steele
Rt. 8, Box 308
Monroe, North Carolina 28110

This site was located in the front yard of the Steele residence 1200 feet south-southeast of the plant. The sampler was mounted on a wooden stand five feet above the ground.

Site B

Location Charlotte Plastics Plant
Monroe, North Carolina

This station was located on the property of the Charlotte Plastics plant. The site was in a grassy area between the plant fence and the Seaboard Air Line Railroad track. It was 20 feet from the fence and 150 feet north of the main plant building. Electrical power for this site was obtained by running a power cord from a small building inside the fenced-in area. Two monitors were located at this site because it was closest to the plant and also in the prevailing wind direction. The samplers were mounted on a wooden stand 5 feet above the ground and 4 feet apart.

Site C

Location Monroe RC Club
Monroe, North Carolina

This site was located on a piece of property that is owned by Charlotte Plastics and leased to the Monroe RC Club. The sampler was located 75 feet from a small building and was 1000 feet west of the plant. The sampler was mounted on a wooden stand five feet above the ground.

Site D

Location Residence of Mr. Campbell, owned and located
on the property of
Kendrick Brick and Tile Co.
Box 779
Monroe, North Carolina

This site was located in the backyard of the Campbell residence and was 2500 feet north-northeast of the plant. The sampler was mounted on a wooden stand five feet above the ground.

Location of Vinyl Chloride Study Sites

ITT, Royal Electric Division
95 Grand Avenue
Pawtucket, Rhode Island 02816

Site A

Location	Residence of	Mr. Stanley Brooks 14 Hutchinson Avenue Pawtucket, Rhode Island 02816
----------	--------------	---

This site was located in the side yard of the Brooks residence 200 feet east of the plant. The sampler was mounted on a wooden stand five feet above the ground.

Site B

Location	Residence of	Mr. Earl Barry 411 Carter Avenue Pawtucket, Rhode Island
----------	--------------	--

This site was located in the front yard of the Barry residence 140 feet southeast of the plant. The sampler was mounted on a wooden stand five feet above the ground.

Site C

Location	Residence of	Mr. A. Mitsmen 335 Carter Avenue Pawtucket, Rhode Island
----------	--------------	--

This site was located in the side yard of the Mitsmen residence 200 feet southwest of the plant. The sampler was mounted on a wooden stand five feet above the ground.

Site D

Location	Residence of	Mr. John Bolton 142 London Avenue Pawtucket, Rhode Island
----------	--------------	---

This site was located in the rear yard of the Bolton residence. Two monitors were located at this site as it was thought to be in the prevailing downwind direction. The samplers were 100 feet north of the plant and were mounted four feet apart and five feet above the ground.

APPENDIX B
METEOROLOGICAL DATA SUMMARY

METEOROLOGICAL DATA SUMMARY

Ford Vinyl Plant
Mount Clemens, Michigan
February 12 to February 25, 1975

DATE 2/12/75

HOURL	WIND SPEED	WIND DIRECTION
00		
01		
02		
03		
04		
05		
06		
07		
08		
09		
10		
11		
12		
13		
14		
15	12	260
16	12	260
17	13	270
18	16	260
19	20	260
20	23	260
21	16	270
22	16	270
23	15	260

DATE 2/13/75

HOURL	WIND SPEED	WIND DIRECTION
00	14	290
01	12	340
02	16	310
03	12	310
04	15	290
05	14	290
06	12	290
07	10	300
08	07	300
09	10	290
10	12	290
11	14	290
12	16	290
13	19	290
14	15	320
15	15	310
16	14	310
17	12	300
18	12	300
19	04	300
20	04	290
21	06	260
22	09	270
23	07	280

DATE 2/14/75

HOURL	WIND SPEED	WIND DIRECTION
00	04	290
01	04	290
02	05	300
03	03	300
04	04	270
05	04	260
06	05	260
07	05	260
08	03	300
09	00	300
10	00	310
11	00	300
12	02	260
13	03	300
14	04	310
15	06	310
16	04	300
17	00	300
18	03	300
19	02	300
20	04	300
21	00	300
22	00	300
23	02	300

DATE 2/15/75

HOURL	WIND SPEED	WIND DIRECTION
00	00	300
01	00	300
02	00	300
03	00	300
04	02	300
05	03	300
06	04	300
07	04	300
08	05	300
09	05	300
10	07	300
11	06	300
12	06	300
13	06	300
14	07	300
15	07	300
16	07	300
17	05	300
18	05	300
19	07	300
20	06	300
21	04	300
22	07	300
23	05	300

Preceding page blank

B-2

METEOROLOGICAL DATA SUMMARY
Ford Vinyl Plant (continued).

DATE 2/16/75

HOOR	WIND SPEED	WIND DIRECTION
00	03	040
01	08	020
02	08	020
03	08	010
04	08	010
05	08	010
06	08	010
07	10	020
08	11	030
09	10	030
10	11	030
11	11	040
12	12	040
13	09	050
14	11	030
15	11	030
16	11	050
17	12	050
18	10	050
19	11	050
20	10	070
21	06	060
22	08	050
23	10	070

DATE 2/17/75

HOOR	WIND SPEED	WIND DIRECTION
00	02	080
01	09	040
02	09	070
03	09	070
04	07	070
05	09	070
06	11	080
07	10	080
08	10	080
09	11	090
10	08	100
11	14	100
12	12	110
13	06	120
14	07	140
15	08	190
16	04	220
17	14	220
18	12	240
19	12	250
20	10	250
21	10	250
22	10	250
23	11	240

DATE 2/18/75

HOOR	WIND SPEED	WIND DIRECTION
00	10	250
01	12	250
02	12	250
03	10	240
04	09	250
05	08	260
06	08	260
07	07	260
08	08	260
09	08	260
10	08	260
11	08	230
12	08	250
13	08	240
14	10	240
15	06	010
16	06	240
17	03	230
18	06	230
19	05	240
20	06	230
21	07	250
22	10	240
23	08	240

DATE 2/19/75

HOOR	WIND SPEED	WIND DIRECTION
00	09	200
01	09	250
02	09	260
03	08	260
04	09	260
05	08	260
06	09	260
07	08	250
08	09	260
09	10	270
10	12	280
11	13	290
12	13	300
13	14	310
14	12	290
15	12	300
16	11	300
17	08	290
18	08	280
19	06	260
20	05	260
21	02	270
22	06	240
23	05	290

METEOROLOGICAL DATA SUMMARY
Ford Vinyl Plant (continued).

DATE 2/20/75

HOURL	WIND SPEED	WIND DIRECTION
00	10	250
01	08	250
02	08	230
03	12	230
04	08	230
05	09	230
06	12	250
07	06	250
08	04	240
09	13	220
10	10	240
11	10	230
12	14	230
13	14	230
14	12	230
15	12	240
16	09	230
17	10	230
18	09	220
19	07	230
20	04	220
21	03	210
22	07	220
23	07	270

DATE 2/21/75

HOURL	WIND SPEED	WIND DIRECTION
00	04	230
01	08	240
02	07	250
03	05	240
04	05	250
05	02	050
06	02	020
07	02	020
08	00	220
09	05	230
10	04	250
11	25	230
12	08	180
13	05	170
14	09	120
15	09	170
16	08	170
17	04	170
18	03	150
19	04	150
20	04	180
21	03	170
22	04	170
23	04	170

DATE 2/22/75

HOURL	WIND SPEED	WIND DIRECTION
00	04	170
01	02	160
02	02	170
03	02	140
04	03	160
05	04	140
06	03	170
07	04	160
08	04	170
09	04	170
10	10	120
11	10	120
12	08	230
13	08	240
14	09	240
15	04	200
16	04	240
17	04	040
18	02	060
19	02	050
20	00	040
21	00	000
22	00	000
23	00	000

DATE 2/23/75

HOURL	WIND SPEED	WIND DIRECTION
00	02	050
01	02	110
02	00	000
03	00	010
04	01	010
05	04	020
06	07	020
07	06	140
08	02	050
09	09	150
10	08	160
11	08	160
12	08	010
13	08	010
14	10	010
15	10	010
16	08	070
17	16	070
18	08	010
19	04	040
20	10	010
21	10	010
22	08	010
23	10	010

METEOROLOGICAL DATA SUMMARY
Ford Vinyl Plant (continued).

DATE 2/24/75

HOUR	WIND SPEED	WIND DIRECTION
00	10	060
01	12	060
02	14	060
03	08	060
04	09	070
05	00	000
06	09	160
07	04	210
08	09	260
09	06	250
10	11	240
11	10	200
12	10	220
13	11	220
14	08	170
15	11	210
16	15	210
17	12	210
18	16	240
19	14	210
20	15	210
21	13	220
22	13	200
23	15	200

DATE 2/25/75

HOUR	WIND SPEED	WIND DIRECTION
00	10	210
01	10	200
02	14	200
03	12	200
04	12	210
05	11	210
06	12	220
07	12	220
08	12	230
09	12	230
10	16	230
11	15	220
12	20	220
13	19	240
14	19	250
15	19	250
16	21	250
17	20	260
18	23	260
19	18	260
20	20	250
21	24	260
22	20	260
23	20	260

METEOROLOGICAL DATA SUMMARY

Congoleum Industries Plant
 Marcus Hook, Pennsylvania
 March 12 to March 26, 1975

DATE 3-12-75

HOURL	WIND SPEED	WIND DIRECTION
00	10	225
01		
02	05	135
03		
04	08	135
05		
06	04	135
07		
08	07	115
09	10	040
10	08	135
11	04	180
12	05	160
13	04	160
14	09	090
15	11	115
16	09	190
17		
18	04	190
19		
20	05	225
21		
22	10	180
23		

DATE 3-13-75

HOURL	WIND SPEED	WIND DIRECTION
00	16	160
01		
02	09	225
03		
04	07	225
05		
06	07	225
07		
08	06	225
09	05	225
10	04	225
11	05	225
12	11	270
13	08	315
14	11	315
15	11	315
16	11	315
17		
18	14	315
19		
20	16	160
21		
22	14	160
23		

DATE 3-14-75

HOURL	WIND SPEED	WIND DIRECTION
00	14	315
01		
02	15	045
03		
04	14	045
05		
06	16	045
07		
08	18	045
09	21	045
10	18	045
11	19	045
12	21	045
13	27	045
14	30	045
15	22	045
16	24	045
17		
18	27	045
19		
20	20	045
21		
22	17	045
23		

DATE 3-15-75

HOURL	WIND SPEED	WIND DIRECTION
00	07	270
01		
02	15	160
03		
04	14	315
05		
06	09	315
07		
08	05	270
09	10	270
10	10	315
11	26	315
12	17	315
13	16	315
14	13	315
15	10	315
16	10	315
17		
18	15	315
19		
20	09	315
21		
22	08	315
23		

METEOROLOGICAL DATA SUMMARY

Congoleum Industries Plant (continued).

DATE 3-16-75

HOOR	WIND SPEED	WIND DIRECTION
00	05	100
01		
02	08	270
03		
04	05	270
05		
06	05	315
07		
08	06	315
09	06	360
10	07	360
11	06	045
12	06	135
13	10	225
14	09	225
15	10	225
16	09	225
17		
18	05	225
19		
20	05	225
21		
22	04	135
23		

DATE 3-17-75

HOOR	WIND SPEED	WIND DIRECTION
00	08	045
01		
02	07	360
03		
04	10	360
05		
06	13	360
07		
08	10	360
09	10	360
10	20	045
11	21	045
12	20	045
13	18	045
14	17	045
15	17	045
16	10	045
17		
18	09	045
19		
20	08	135
21		
22	05	135
23		

DATE 3-18-75

HOOR	WIND SPEED	WIND DIRECTION
00	11	045
01		
02	10	045
03		
04	09	045
05		
06	10	045
07		
08	09	045
09	09	045
10	10	045
11	10	135
12	10	135
13	07	135
14	10	135
15	10	135
16	10	135
17		
18	10	135
19		
20	11	135
21		
22	11	045
23		

DATE 3-19-75

HOOR	WIND SPEED	WIND DIRECTION
00	08	090
01		
02	12	090
03		
04	14	045
05		
06	13	090
07		
08	10	090
09	12	090
10	12	090
11	20	090
12	24	135
13	24	135
14	24	135
15	23	135
16	18	180
17		
18	16	135
19		
20	08	045
21		
22	06	135
23		

METEOROLOGICAL DATA SUMMARY

Congoleum Industries Plant (continued).

DATE 3-20-75

HOOR	WIND SPEED	WIND DIRECTION
00	14	315
01		
02	10	225
03		
04	10	225
05		
06	09	270
07		
08	12	315
09	14	315
10	14	315
11	18	315
12	20	315
13	22	315
14	20	315
15	18	315
16	18	315
17		
18	22	315
19		
20	22	315
21		
22	23	315
23		

DATE 3-21-75

HOOR	WIND SPEED	WIND DIRECTION
00	07	225
01		
02	08	215
03		
04	07	315
05		
06	07	315
07		
08	06	270
09	06	315
10	10	315
11	10	315
12	12	315
13	10	315
14	11	315
15	11	315
16	10	315
17		
18	08	225
19		
20	08	225
21		
22	07	245
23		

DATE 3-22-75

HOOR	WIND SPEED	WIND DIRECTION
00	19	315
01		
02	12	180
03		
04	14	245
05		
06	14	245
07		
08	10	090
09	09	180
10	10	180
11	17	180
12	09	135
13	10	135
14	12	135
15	11	180
16	16	225
17		
18	18	225
19		
20	13	225
21		
22	14	225
23		

DATE 3-23-75

HOOR	WIND SPEED	WIND DIRECTION
00	04	090
01		
02	10	315
03		
04	12	315
05		
06	12	315
07		
08	06	270
09	09	315
10	12	315
11	14	315
12	12	315
13	10	315
14	10	315
15	11	315
16	09	270
17		
18	10	270
19		
20	07	270
21		
22	06	270
23		

METEOROLOGICAL DATA SUMMARY

Congoleum Industries Plant (continued).

DATE 3-24-75

HOOR	WIND SPEED	WIND DIRECTION
00	11	275
01		
02	05	315
03		
04	05	180
05		
06	06	090
07		
08	10	045
09	04	045
10	07	045
11	08	135
12	07	135
13	05	135
14	06	045
15	06	045
16	08	045
17		
18	09	360
19		
20	10	045
21		
22	04	225
23		

DATE 3-25-75

HOOR	WIND SPEED	WIND DIRECTION
00	12	315
01		
02	11	325
03		
04	11	225
05		
06	12	225
07		
08	07	225
09	06	225
10	07	225
11	07	225
12	08	225
13	08	225
14	09	225
15	07	315
16	12	315
17		
18	13	315
19		
20	12	315
21		
22	15	315
23		

DATE 3-26-75

HOOR	WIND SPEED	WIND DIRECTION
00		
01		
02	12	315
03		
04	10	315
05		
06	10	270
07		
08	10	270
09	12	315
10	13	315
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		

METEOROLOGICAL DATA SUMMARY

Reynolds Metals Company Plant
Grottoes, Virginia
March 14 to March 28, 1975

DATE 3/14/75

HOUR	WIND SPEED	WIND DIRECTION
00		
01		
02		
03		
04		
05	10	040
06	10	090
07	09	060
08	15	060
09	08	050
10	06	070
11	07	010
12	06	010
13	07	030
14	08	060
15	08	050
16	08	160
17	05	050
18	05	160
19	08	040
20	00	000
21	05	270
22	05	270
23		

DATE 3/15/75

HOUR	WIND SPEED	WIND DIRECTION
00		
01		
02		
03		
04		
05		
06		
07		
08	00	000
09	00	000
10	05	040
11	05	020
12	05	030
13	00	000
14	05	240
15	00	000
16	04	060
17	04	100
18	05	120
19	05	150
20	00	000
21	00	000
22	00	000
23		

DATE 3/16/75

HOUR	WIND SPEED	WIND DIRECTION
00		
01		
02		
03		
04		
05		
06		
07		
08	05	000
09	08	200
10	10	200
11	10	180
12	10	140
13	15	180
14	10	200
15	08	180
16	00	000
17	05	190
18	05	150
19	05	040
20	05	040
21	00	000
22	05	160
23		

DATE 3/17/75

HOUR	WIND SPEED	WIND DIRECTION
00		
01		
02		
03		
04		
05	10	040
06	10	150
07	10	10
08	10	150
09	05	060
10	05	180
11	04	080
12	05	090
13	05	120
14	05	160
15	05	160
16	05	150
17	05	110
18	05	090
19	00	000
20	05	120
21	05	180
22	05	170
23	00	000

METEOROLOGICAL DATA SUMMARY

Reynolds Metals Company Plant (continued).

DATE 3/18/75

HOURL	WIND SPEED	WIND DIRECTION
00		
01		
02		
03		
04		
05	05	350
06	04	340
07	00	000
08	00	000
09	00	000
10	05	160
11	05	150
12	05	160
13		
14	04	160
15	05	180
16	00	000
17	00	000
18	05	360
19	05	340
20	05	310
21	05	360
22		
23		

DATE 3/19/75

HOURL	WIND SPEED	WIND DIRECTION
00		
01		
02		
03		
04		
05	05	060
06	04	300
07	05	030
08	10	060
09	10	360
10	10	040
11	05	150
12	00	000
13	05	340
14	04	280
15	05	330
16	05	240
17	08	320
18	05	320
19	10	310
20	10	030
21	15	320
22		
23		

DATE 3/20/75

HOURL	WIND SPEED	WIND DIRECTION
00		
01		
02		
03		
04		
05	10	320
06	10	320
07	05	300
08	10	320
09	12	320
10	12	340
11	15	320
12	15	330
13	19	330
14	16	320
15	11	320
16	17	330
17	16	350
18	11	340
19	11	330
20	08	330
21	07	310
22		
23		

DATE 3/21/75

HOURL	WIND SPEED	WIND DIRECTION
00		
01		
02		
03		
04		
05	00	000
06	00	000
07	00	000
08	05	210
09	03	240
10	04	180
11	05	210
12	10	180
13	08	150
14	06	210
15	12	180
16	10	180
17	08	180
18	10	180
19	08	160
20	10	150
21	00	000
22	00	000
23		

METEOROLOGICAL DATA SUMMARY

Reynolds Metals Company Plant (continued).

DATE 3/22/75

HOUR	WIND SPEED	WIND DIRECTION
00		
01		
02		
03		
04		
05		
06		
07		
08	05	250
09	08	230
10	10	200
11	10	200
12	10	240
13	10	240
14	08	240
15		
16	08	230
17	08	230
18	05	220
19	05	270
20	08	270
21	05	270
22		
23		

DATE 3/23/75

HOUR	WIND SPEED	WIND DIRECTION
00		
01		
02		
03		
04		
05		
06		
07		
08	00	000
09	00	000
10	04	250
11	05	200
12	05	070
13		
14	10	170
15	05	190
16	05	180
17	08	210
18	05	190
19	05	180
20	05	180
21	05	210
22	05	220
23		

DATE 3/24/75

HOUR	WIND SPEED	WIND DIRECTION
00		
01		
02		
03		
04		
05	05	200
06	08	200
07	05	240
08	05	220
09	05	220
10	05	210
11	05	210
12	05	330
13	05	110
14	04	230
15	08	220
16	08	200
17	08	190
18	08	210
19	05	220
20	08	220
21	10	220
22	05	270
23		

DATE 3/25/75

HOUR	WIND SPEED	WIND DIRECTION
00		
01		
02		
03		
04		
05	05	300
06	05	210
07	05	30
08	08	240
09	10	140
10	15	300
11	10	240
12	10	240
13	15	260
14	15	270
15	12	270
16	12	270
17	08	300
18	12	280
19	10	330
20	10	330
21	12	330
22	10	170
23		

METEOROLOGICAL DATA SUMMARY

Reynolds Metals Company Plant (continued).

DATE 1/24/75

HOURL	WIND SPEED	WIND DIRECTION
00		
01		
02		
03		
04		
05	08	290
06	10	290
07	11	110
08	05	110
09	10	120
10	12	100
11	10	110
12	10	110
13	08	100
14	10	210
15	10	110
16	10	010
17		
18	10	010
19	05	010
20	05	040
21	05	210
22		

DATE 1/27/75

HOURL	WIND SPEED	WIND DIRECTION
00		
01		
02		
03		
04		
05	00	000
06	00	000
07	00	000
08	05	000
09	10	000
10	10	000
11	08	000
12	07	000
13	07	020
14	05	000
15		
16	05	070
17	05	110
18	00	000
19	00	000
20	00	000
21	00	000
22	00	000

DATE 1/28/75

HOURL	WIND SPEED	WIND DIRECTION
00		
01		
02		
03		
04		
05	00	000
06	00	020
07	00	000
08	05	010
09	05	100
10	05	040
11	02	210
12	02	240
13	05	240
14	05	210
15	10	210
16	10	200
17	05	190
18	05	200
19	05	210
20	00	000
21	05	200
22	05	200

METEOROLOGICAL DATA SUMMARY

Charlotte Plastics
Monroe, North Carolina
April 10 to April 24, 1975

DATE 4/10/75

HR	WIND SPEED	WIND DIRECTION
00		
01	00	230
02	00	230
03	00	230
04	00	230
05	00	230
06	00	230
07	00	230
08	00	230
09	00	230
10	00	230
11	00	230
12	00	230
13	00	230
14	00	230
15	00	230
16	00	230
17	00	230
18	00	230
19	00	230
20	00	230
21	00	230
22	00	230
23	00	230

DATE 4/11/75

HR	WIND SPEED	WIND DIRECTION
00	04	110
01	03	300
02	03	090
03	03	090
04	03	340
05	07	350
06	09	140
07	11	120
08	07	080
09	10	060
10	08	090
11	06	090
12	07	080
13	09	100
14	07	030
15	08	120
16	05	130
17	05	170
18	07	160
19	05	150
20	06	130
21	07	040
22	12	030
23	13	020

DATE 4/12/75

HR	WIND SPEED	WIND DIRECTION
00	00	050
01	00	140
02	04	160
03	04	140
04	03	120
05	07	140
06	03	120
07	06	130
08	06	140
09	12	110
10	15	100
11	09	150
12	12	100
13	08	270
14	17	200
15	19	200
16	12	120
17	07	130
18	09	130
19	06	130
20	07	140
21	06	150
22	05	140
23	07	130

DATE 4/13/75

HR	WIND SPEED	WIND DIRECTION
00	03	010
01	06	140
02	07	160
03		030
04	04	020
05	00	000
06	03	090
07	03	140
08	06	10
09	04	060
10	03	090
11	04	080
12	06	060
13	06	140
14	11	220
15	10	190
16	11	240
17	09	230
18	05	220
19	03	140
20	05	180
21	04	220
22	05	170
23	03	100

METEOROLOGICAL DATA SUMMARY
Charlotte Plastics (continued).

DATE 6/16/75

HOUR	WIND SPEED	WIND DIRECTION
00	03	090
01	03	240
02	05	150
03	07	180
04	04	090
05	03	120
06	03	070
07	08	020
08	09	020
09	09	080
10	09	070
11	07	100
12	07	220
13	06	180
14	03	180
15	11	170
16	11	70
17	08	170
18	04	240
19	07	170
20	07	180
21	09	100
22	18	240
23	10	240

DATE 6/19/75

HOUR	WIND SPEED	WIND DIRECTION
00	10	160
01	09	100
02	07	350
03	08	200
04	09	200
05	06	240
06	07	240
07	06	330
08	07	240
09	07	300
10	08	140
11	08	200
12	10	210
13	12	200
14	12	200
15	13	210
16	12	220
17	12	240
18	12	220
19	10	240
20	10	220
21	08	220
22	12	220
23	12	260

DATE 6/16/75

HOUR	WIND SPEED	WIND DIRECTION
00	12	200
01	06	350
02	14	260
03	05	350
04	05	350
05	04	240
06	00	000
07	03	240
08	08	240
09	12	240
10	14	240
11	13	100
12	12	280
13	13	210
14	08	220
15	08	250
16	09	200
17	08	240
18	03	200
19	03	200
20	03	180
21	02	240
22	04	220
23	00	000

DATE 6/17/75

HOUR	WIND SPEED	WIND DIRECTION
00	00	000
01	05	100
02	00	000
03	00	000
04	03	100
05	03	080
06	00	070
07	02	070
08	00	040
09	09	090
10	07	120
11	03	110
12	08	100
13	08	190
14	05	120
15	07	170
16	08	200
17	07	120
18	07	120
19	07	110
20	04	120
21	07	120
22	08	170
23	10	200

WIND OBSERVATIONAL DATA SUMMARY

High Level Plastics (continued)

DATE 5/18/75

HOUR	WIND SPEED	WIND DIRECTION
00	14	210
01	13	240
02	12	240
03	13	270
04	14	240
05	13	240
06	10	240
07	09	240
08	07	210
09	11	210
10	14	210
11	17	210
12	16	240
13	18	210
14	19	210
15	12	210
16	15	210
17	13	210
18	12	210
19	11	210
20	14	210
21	19	210
22	18	210
23	20	240

DATE 5/19/75

HOUR	WIND SPEED	WIND DIRECTION
00	08	180
01	16	210
02	14	210
03	13	210
04	16	210
05	15	210
06	15	240
07	14	240
08	16	240
09	22	210
10	21	210
11	21	210
12	17	210
13	18	240
14	18	240
15	14	210
16	11	210
17	14	210
18	11	240
19	15	210
20	12	240
21	09	240
22	10	210
23	07	210

DATE 5/20/75

HOUR	WIND SPEED	WIND DIRECTION
00	16	240
01	18	210
02	16	210
03	17	210
04	14	240
05	13	210
06	14	210
07	16	240
08	14	240
09	16	210
10	17	210
11	16	210
12	14	210
13	17	210
14	14	210
15	13	210
16	12	210
17	11	210
18	10	210
19	11	210
20	12	210
21	14	210
22	15	210
23	14	210

DATE 5/21/75

HOUR	WIND SPEED	WIND DIRECTION
00	19	240
01	24	210
02	21	210
03	14	210
04	13	210
05	16	210
06	18	210
07	27	210
08	12	210
09	11	210
10	17	210
11	18	210
12	17	210
13	14	210
14	16	210
15	14	210
16	14	210
17	14	210
18	14	210
19	14	210
20	14	210
21	14	210
22	14	210
23	14	210

METEOROLOGICAL DATA SUMMARY
Charlotte Plastics (continued).

DATE 4/23/75

HR	WIND SPEED	WIND DIRECTION
00	00	000
01	00	000
02	00	000
03	00	000
04	03	010
05	05	010
06	05	070
07	03	080
08	05	060
09	04	140
10	04	100
11	07	100
12	07	170
13	08	260
14	10	130
15	08	200
16	10	200
17	08	190
18	09	210
19	05	180
20	07	190
21	07	190
22	07	170
23	06	100

DATE 4/22/75

HR	WIND SPEED	WIND DIRECTION
00	07	180
01	08	180
02	09	210
03	10	210
04	08	200
05	04	210
06	00	000
07	06	210
08	07	220
09	14	210
10	14	210
11	16	200
12	14	210
13	13	190
14	16	210
15	15	210
16	14	200
17	15	210
18	12	200
19	10	200
20	09	210
21	10	190
22	10	210
23	13	220

DATE 4/24/75

HR	WIND SPEED	WIND DIRECTION
00	14	190
01	10	190
02	11	190
03	12	190
04	10	200
05	11	190
06	09	220
07	08	190
08	14	240
09	15	220
10	17	220
11	15	210
12	18	210
13	14	220
14	18	220
15	18	210
16	14	210
17	17	200
18	14	210
19	12	200
20	14	210
21	16	220
22	18	200
23	11	210

METEOROLOGICAL DATA SUMMARY

ITT, Royal Electric Division
Pawtucket, Rhode Island
May 22 to June 4, 1975

DATE 5-22-75

HOUR	WIND SPEED	WIND DIRECTION
00	06	040
01	07	040
02	08	040
03	07	040
04	04	040
05	07	040
06	06	040
07	05	040
08	05	045
09	04	035
10	03	035
11	02	105
12	01	145
13	04	105
14	05	155
15	09	155
16	09	150
17	06	150
18	05	140
19	03	200
20	03	200
21	04	215
22	03	190
23	02	180

DATE 5-23-75

HOUR	WIND SPEED	WIND DIRECTION
00	02	190
01	02	200
02	02	200
03	02	215
04	01	205
05	02	210
06	02	215
07	02	185
08	04	155
09	04	155
10	06	155
11	09	155
12	11	155
13	10	155
14	12	150
15	10	145
16	07	170
17	11	220
18	08	220
19	08	220
20	08	225
21	07	225
22	06	230
23	07	240

DATE 5-24-75

HOUR	WIND SPEED	WIND DIRECTION
00	04	250
01	05	245
02	04	245
03	04	250
04	02	220
05	03	225
06	02	220
07	02	215
08	03	150
09	02	140
10	07	140
11	06	145
12	09	155
13	09	015
14	09	070
15	08	070
16	10	050
17	08	075
18	09	080
19	09	080
20	07	080
21	07	070
22	07	045
23	08	045

DATE 5-25-75

HOUR	WIND SPEED	WIND DIRECTION
00	02	245
01	04	245
02	05	230
03	04	260
04	07	260
05	06	250
06	05	120
07	04	120
08	03	120
09	06	180
10	05	185
11	06	180
12	06	120
13	05	140
14	08	150
15	08	145
16	09	210
17	07	270
18	06	180
19	05	155
20	08	45
21	06	165
22	05	170
23	04	170

METEOROLOGICAL DATA SUMMARY

ITT, Royal Electric Division (continued).

DATE 9-26-75

HOURL	WIND SPEED	WIND DIRECTION
00	06	180
01	07	200
02	07	260
03	07	210
04	07	210
05	07	210
06	07	210
07	06	220
08	06	220
09	07	210
10	10	220
11	10	220
12	11	220
13	10	220
14	11	220
15	12	220
16	12	220
17	10	220
18	08	220
19	07	210
20	08	220
21	08	220
22	05	220
23	05	220

DATE 9-27-75

HOURL	WIND SPEED	WIND DIRECTION
00	05	220
01	04	210
02	03	210
03	04	220
04	04	220
05	03	220
06	03	220
07	04	200
08	04	200
09	08	260
10	03	270
11	03	260
12	08	260
13	03	260
14	02	260
15	04	260
16	06	180
17	04	160
18	03	230
19	02	220
20	02	220
21	04	200
22	08	160
23	07	160

DATE 9-28-75

HOURL	WIND SPEED	WIND DIRECTION
00	06	290
01	07	290
02	04	310
03	05	300
04	04	310
05	08	320
06	09	310
07	11	320
08	12	330
09	12	330
10	12	320
11	12	320
12	10	310
13	09	310
14	08	310
15	08	300
16	09	310
17	09	300
18	05	280
19	04	280
20	04	280
21	04	300
22	04	310
23	07	320

DATE 9-29-75

HOURL	WIND SPEED	WIND DIRECTION
00	04	320
01	04	330
02	04	320
03	03	310
04	04	330
05	04	350
06	04	340
07	03	290
08	07	340
09	07	340
10	08	310
11	06	310
12	08	280
13	07	300
14	07	280
15	08	190
16	08	160
17	02	150
18	06	150
19	07	150
20	04	160
21	04	160
22	04	160
23	03	160

METEOROLOGICAL DATA SUMMARY

ITT, Royal Electric Division (continued).

DATE 5-29-75

HOUR	WIND SPEED	WIND DIRECTION
00	02	150
01	02	155
02	01	155
03	01	155
04	01	150
05	01	150
06	01	150
07	03	150
08	06	150
09	08	150
10	10	145
11	14	145
12	14	150
13	10	170
14	08	185
15	07	205
16	05	200
17	04	155
18	04	165
19	08	170
20	08	170
21	07	165
22	04	170
23	04	170

DATE 5-31-75

HOUR	WIND SPEED	WIND DIRECTION
00	05	175
01	05	175
02	06	180
03	06	205
04	08	210
05	05	215
06	07	180
07	04	180
08	08	150
09	09	150
10	10	155
11	12	155
12	12	155
13	13	170
14	10	180
15	09	210
16	08	215
17	05	180
18	08	210
19	04	180
20	04	170
21	04	175
22	04	180
23	03	180

DATE 6-1-75

HOUR	WIND SPEED	WIND DIRECTION
00	04	180
01	03	170
02	05	175
03	05	190
04	05	180
05	05	170
06	08	205
07	08	215
08	09	215
09	07	210
10	07	215
11	06	210
12	08	210
13	05	210
14	06	160
15	06	175
16	05	245
17	05	270
18	04	020
19	06	025
20	05	045
21	05	055
22	04	065
23	04	100

DATE 6-2-75

HOUR	WIND SPEED	WIND DIRECTION
00	04	150
01	04	040
02	05	040
03	06	115
04	05	115
05	05	125
06	06	120
07	06	140
08	10	140
09	09	120
10	08	110
11	09	115
12	08	290
13	06	115
14	07	110
15	07	280
16	08	290
17	07	110
18	04	180
19	05	290
20	06	290
21	04	175
22	02	075
23	01	180

METEOROLOGICAL DATA SUMMARY

ITT, Royal Electric Division (continued).

DATE 6-3-75

HOUR	WIND SPEED	WIND DIRECTION
00	02	325
01	01	310
02	01	270
03	01	275
04	01	285
05	01	010
06	01	020
07	01	175
08	03	150
09	04	150
10	04	175
11	08	350
12	05	025
13	06	090
14	06	100
15	06	130
16	04	090
17	08	075
18	04	135
19	02	090
20	02	120
21	05	160
22	07	170
23	04	190

DATE 6-4-75

HOUR	WIND SPEED	WIND DIRECTION
00	02	325
01	03	280
02	03	240
03	02	250
04	03	295
05	04	310
06	03	310
07	04	315
08	06	315
09	07	350
10	07	090
11	07	085
12	09	355
13	15	360
14	14	350
15	13	350
16	10	355
17	08	090
18	08	110
19	09	055
20	07	045
21	05	030
22	04	030
23	03	360

APPENDIX C
EPA METHOD FOR THE ANALYSIS
OF VINYL CHLORIDE

TENTATIVE METHOD FOR THE DETERMINATION OF VINYL CHLORIDE
IN THE ATMOSPHERE (24-HOUR INTEGRATED SAMPLING)

OCTOBER 1974

This method has been drafted from available information and reviewed editorially within the Methods Standardization and Performance Evaluation Branch, QAEML. The method has received no laboratory evaluation, is still under investigation and, therefore, is subject to revision.

U.S. ENVIRONMENTAL PROTECTION AGENCY
METHODS STANDARDIZATION AND PERFORMANCE EVALUATION BRANCH
QUALITY ASSURANCE AND ENVIRONMENTAL MONITORING LABORATORY
NATIONAL ENVIRONMENTAL RESEARCH CENTER
RESEARCH TRIANGLE PARK, NORTH CAROLINE 27711

October 22, 1974

Tentative Method for the Determination of
 Vinyl Chloride in the Atmosphere
 By 24-Hour Integrated Sampling

1. Principle and Applicability.

1.1 Vinyl chloride (chloroethene) is absorbed from air onto charcoal adsorbers, which are subsequently extracted with carbon disulfide. The resulting solutions are then measured chromatographically, using a flame ionization detector.

1.2 The method is applicable to the measurement of vinyl chloride in ambient air using a 24-hour sampling period.*

2. Range and Sensitivity. The limit of detection is approximately 0.003 mg/m^3 (1 ppb). The maximum of the range is 20 mg/m^3 (8 ppm); it may be increased by extending the calibration range or by diluting the sample.

3. Interferences. At the present time, there are no known common pollutants in the ambient atmosphere in sufficient concentrations to interfere with the measurement of vinyl chloride. However, certain volatile hydrocarbons and Freons have elution characteristics similar

*Warning: Vinyl chloride is a suspected carcinogen. Care must be exercised to protect operators from breathing vinyl chloride fumes. Carbon disulfide is toxic and its vapors form explosive mixtures with air. Work with this material in a well ventilated fume hood.

to vinyl chloride. Among the latter is Freon 12 (dichlorodifluoromethane). Under certain conditions, a peak is associated with the injection and subsequent withdrawal of the microsyringe into and from the G.C. septum. These peaks can also give interferences with the vinyl chloride peak.

4. Precision and Accuracy. Replicate gas chromatographic analyses of standard gas mixtures and sample aliquots should not deviate by more than 3 per cent relative standard deviation. When the entire analysis is repeated, preliminary studies indicate that relative standard deviations of 6 per cent are attainable. No information is presently available on accuracy.

5. Apparatus.

5.1 Sampling - Air Monitoring Materials

5.1.1 Pump - Capable of maintaining an air pressure differential greater than 0.5 atmospheres at the desired flow rate.

5.1.2 Critical Orifice - Twenty-seven gauge 3/8" hypodermic needle. To control flow rate at approximately 200 ml/min.

5.1.3 Tubing - 18 cm length of 10 mm O.D. borosilicate glass with tapered ends, to prepare adsorption tube.

5.1.4 Serum caps - 5 x 9 mm and 7 x 11 mm sizes.

5.1.5 Vibrator - To achieve close packing of the adsorption tube.

5.1.6 Air flow meter - Rotameter type; 1 - 200 ml/min range. To calibrate critical orifice.

- 5.1.7 Furnace, muffle - To operate at 400⁰ C.
- 5.2 Sample recovery.
 - 5.2.1 Graduated cylinder - Glass stoppered; capacity, 25 ml (TC).
 - 5.2.2 Pipette, dropping - 2 ml.
 - 5.2.3 Serum bottle - Narrow mouth for septum sealing; 2 ml.
 - 5.2.4 Serum cap - With teflon coating on the side of the septum exposed to the sample 5 x 9 mm size. (Hewlett-Packard #5080-8713¹ has been found to be satisfactory.)
 - 5.2.5 Aluminum serum cap seal.
 - 5.2.6 Crimper - For use with aluminum serum cap seals.
- 5.3 Analysis.
 - 5.3.1 Gas chromatograph - With flame ionization detector and potentiometric strip chart recorder.
 - 5.3.2 Chromatographic column - Borosilicate glass, 2.5 m x 2 mm I.D., containing 0.4% Carbowax 1500 on Carbopak A packing. (w/w)
 - 5.3.3 Microsynges - 0 to 10 and 0 to 100 microliter range, graduated.
 - 5.3.4 Syringes, sampling - Gas tight, 1 ml and 50 ml, graduated.
 - 5.3.5 Sampling loop - one ml.
 - 5.3.6 Flow meter - Rotometer type, 0 to 100 ml/min capacity.
 - 5.3.7 Gas regulator - 4 to 50 psig range.
 - 5.3.8 Gas sample bags - Poly(vinyl fluoride). Sixteen inch square and seven inch square sizes.
 - 5.3.9 Stop watch - To time gas flow in preparation of standard gas mixtures.

¹ Mention of trade names or specific products does not constitute endorsement by the Environmental Protection Agency.

6. Reagents

Unless otherwise indicated, it is intended that all reagents be chromatographic grade or conform to the specifications established by the Committee of Analytical Reagents of the American Chemical Society, where such specifications are available; otherwise, use best available grade.

6.1 Sampling

6.1.1 Charcoal - Activated coconut shell charcoal. (Fisher Scientific Company, ¹ 6 to 16 mesh is effective.)

6.1.2 Glass wool - borosilicate

6.1.3 Aluminum foil.

6.2 Sample recovery.

6.2.1 Carbon disulfide.

6.3 Analysis.

6.3.1 Nitrogen gas - Zero grade, for chromatographic carrier gas and for preparation of standard gas samples.

6.3.2 Vinyl chloride - 128 mg/l^3 at 25°C , 1 atm (50 ppm v/v) in zero nitrogen. Analyzed. For calibration.

6.3.3 Combustion Air - Containing less than 1.0 mg/l^3 hydrocarbons (2 ppm v/v -100 v/v) to operate flame ionization detector.

7. Procedure.

7.1 Sampling.

7.1.1 Activation of charcoal - Heat charcoal to 400°C for one hour to remove adsorbed gases. Store in a sealed container.

7.1.2 Preparation of adsorption tube - Insert glass wool into tubing [see Section 5.1.3] and tamp into position at one end to a depth of approximately 2.5 cm. Mount tube on vibrator in a vertical position. Add charcoal a little at a time and vibrate after each addition to prevent channelling. Fill tube to a depth of 13 cm with charcoal. Insert glass wool into remainder of tube. Prepare additional adsorption tubes in a similar and uniform manner. Cover ends of tubes with serum caps. Wrap with aluminum foil to protect tubes from light during storage and subsequent use. Insert critical orifice through septum at one end of tube. Retain until calibration, sampling and recalibration procedures have been completed.

7.1.3 Twenty-four hour sample collection. Remove serum cap from one end of the adsorption tube and mount it with open end downward. Connect critical orifice to the sampling train. Begin drawing air through the tube. Record time and adsorption tube number. Continue sampling for at least 23 hrs 45' but for not more than 24 hrs 15'. At end of sampling interval, record time, disconnect adsorption tube from sampling train and protect open end with serum cap. Remove sample to analytical area. Protect tube from light.

7.2 Sample recovery. Fill the graduated cylinder to the 25 ml mark with carbon disulfide, stopper and cool in an ice bath. Remove cap and glass wool from one end of the adsorption tube and, with continued cooling, rapidly add charcoal to the carbon disulfide. Stopper cylinder immediately. (Note: The mixing of charcoal and carbon disulfide is an exothermic process that causes local boiling of the solution. The

mixture must be made and the latter step must be solvent loss of vinyl chloride. The temperature of the mixture is held for one half-hour in the hot bath. Mix thoroughly and draw off ten ml of the supernatant liquid. Carefully fill 2 ml sugar bottle, cap and seal.

7.3 Analysis.

7.3.1 Column conditioning. Prior to its initial use, the chromatogram should be heat treated to remove impurities. To do this, establish a steady state flow of zero nitrogen through the column and raise its temperature from ambient by 2° C/min to 200° C. Maintain these conditions for 48 hours, or until base line drift is eliminated.

7.3.2 Operating conditions. Set the column temperature to 60° C and the oven temperature to at least 170° C. Operate the flame ionization detector at the temperature specified by the manufacturer. Using zero nitrogen as the carrier gas, establish a flow rate in the flow assembly with the manufacturer's requirements for satisfactory detector operation. A flow rate of 10 ml/min has been shown to produce good detector operation. Observe the base line periodically and determine if the base line has stabilized and that base-line drift is negligible. Draw a 10-ml aliquot of the supernatant solution of the sample and draw the gas chromatograph. Mark the injection point on the chart. (The injection point is defined as the position of the peak on the chart at the time of sample injection.) Record the sample number, the column temperature, carrier gas flow rate, chart speed and the detector setting. From the chart, select the peak having

the retention time corresponding to vinyl chloride. (See Sect. 8.3 below). Measure the peak height, H_p , the distance in chart divisions from the average value at the baseline to the maximum of the wave form. Record H_p and the retention time. Purge the column at 160°C for five minutes.

B. Calibration and Standards.

B.1 Calibration of absorption tube flow rates. Connect absorption tube to sampling train as in 7.1.3, above. Connect flowmeter in series. Turn on pump and measure flow rate. Record flow rate and adsorption tube number. Repeat flow rate calibration procedure after sample collection. Denote flow rate before sampling as F_1 ; denote flow rate after sampling as F_2 .

B.2 Preparation of vinyl chloride standard gas mixtures. Evacuate a 16-inch square gas sample bag and meter-in 2.00 liters of the 128 mg/m^3 (50 ppm) standard vinyl chloride gas mixture into the bag. Meter-in 3.00 liters of zero nitrogen. This gives a concentration of 51 mg/m^3 (20 ppm) of vinyl chloride. In a like manner, prepare dilutions having 12.8 (5 ppm), 2.55 (1 ppm), 0.51 (0.2 ppm) and 0.15 (0.06 ppm) mg/m^3 vinyl chloride concentrations. (Alternately, calibration samples may be prepared from 99% vinyl chloride gas, using appropriate dilution factors.)

B.3 Determination of vinyl chloride retention time. Establish chromatographic conditions identical with those in 7.3.2, above. Set attenuator to X 1 position. Flush 1.0 ml sampling loop with zero nitrogen and inject into gas inlet port. Mark the injection point on the chart and record the column temperature, the carrier gas flow rate, the chart

speed and the attenuator setting. Record peaks and detector responses that occur in the absence of vinyl chloride. Maintain conditions. Flush 1.0 ml sampling loop with 5 ml of the 0.16 mg/m^3 (0.05 ppm) vinyl chloride calibration mixture and inject into gas chromatograph. Mark the injection point on the chart. Select the peak that corresponds to vinyl chloride. Measure the distance on the chart in mm from the injection point to the peak maximum. This distance, divided by the chart speed in mm/min, is defined as the retention time. Record.

8.4 Preparation of chromatograph calibration curve. Make a gas chromatographic measurement of each standard gas mixture described in Section 8.2 (0.16 mg/m^3 through 128 mg/m^3), using conditions identical with those listed in Section 7.3.2, above. Flush the 1.0 ml sampling loop with at least 5 ml of standard gas mixture and inject into gas chromatograph. Record W_{VC} , the quantity of vinyl chloride injected (in nanograms), the attenuator setting, chart speed, peak height and retention time. Calculate H_C , the peak height multiplied by the attenuator setting. Plot W_{VC} vs H_C . Repeat until replicate measurements do not deviate by more than 3 percent relative standard deviation and draw a smooth curve through the points. Check calibration after every fifth analysis using the 0.16 mg/m^3 (0.05 ppm) standard gas mixture. Recalibrate daily, and whenever remeasurement of a standard gas sample deviates from its calibration value by more than 6%.

9. Calculations.

9.1 Uncorrected value. The volume of air sample is not corrected to S.T.P., because of the uncertainty associated with 24-hour averaging.

temperature and pressure values. Determine the air sample volume taken for analysis.

$$V_m = \frac{F_1 + F_2}{2} \times T \times 10^{-6},$$

where:

V_m = The volume of gas sampled (uncorrected), m^3 .

F_1 = The measured flow rate before sampling, ml/min .

F_2 = The measured flow rate after sampling, ml/min .

T = The sampling time, min .

9.2 Determine the sample peak height as follows:

$$H_C = H_m A_m,$$

where:

H_C = The sample peak height, chart divisions.

H_m = The measured peak height, chart divisions.

A_m = The attenuator setting.

9.3 Vinyl chloride concentration.

9.3.1 Calculate the vinyl chloride concentration as mg/m^3 . From the calibration curve described in Section 8.4, above, select the value of W_{VC} that corresponds to H_C , the sample peak height.

$$\begin{aligned} C_{VC} &= \frac{W_{VC} V_s}{V_m V_i} \\ &= \frac{W_{VC}}{V_m} \times 10^{-2}, \end{aligned}$$

where:

C_{VC} = The concentration of vinyl chloride in the air sample, ng/m^3 .

W_{VC} = The quantity of vinyl chloride recovered by gas chromatography, ng.

V_s = The total volume of carbon disulfide in which the vinyl chloride sample is contained, 25 ml.

V_m = The uncorrected sample volume, from 9.1 above, m^3 .

V_i = The volume of carbon disulfide solution injected into the chromatograph for analysis, 0.0025 ml.

9.3.2 If desired, the concentration of vinyl chloride may be calculated as parts per million vinyl chloride.

$$\text{ppm VC} = \text{ng VC}/\text{m}^3 \times 10^{-3} = 0.0014$$

10. Effects of storage. Charcoal tubes containing adsorbed vinyl chloride have been found to be stable for more than seven days, though there is some evidence that they are adversely affected by strong sunlight. Carbon disulfide solutions lose vinyl chloride to the atmosphere but have been stored unchanged for more than a month in sealed serum bottles having minimal leakage. Gas standards may be kept in poly (vinyl fluoride) gas sample bags for several weeks without undergoing concentration changes. However, present knowledge of the stability of vinyl chloride samples is based on studies with pure substances. No information is available on the storage of samples containing other gaseous substances which is only found in a limited way.

11. References.

Lodge, J. P., Patel, J. B., Smith, D. E. and Swanson, W. A.

"The Use of Gyroscopic Nozzles as Critical Orifice in Air Samplings." J. Air Pollution Control Association, 16:4, 197-200, (1966)

"Vinyl Chloride Monitoring Near the B.F. Goodrich Chemical Company in Louisville, Kentucky." Region IV, U.S. Environmental Protection Agency, Surveillance and Analysis Division, Athens, Georgia.
June 24, 1974.

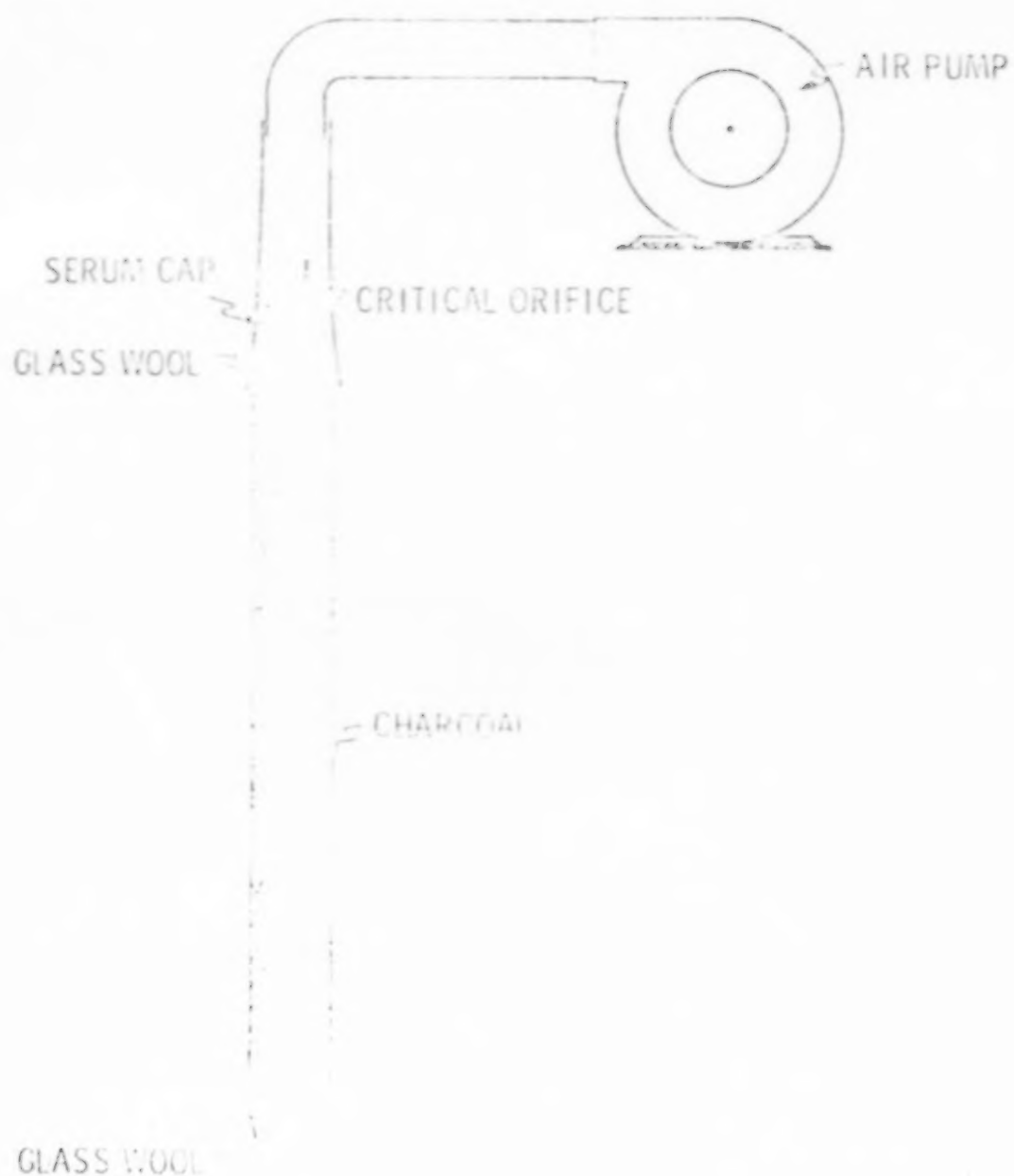


Figure 12-1. Air monitoring apparatus.

PEDCO-ENVIRONMENTAL

SUITE 12 • ATKINSON SQUARE

CINCINNATI OHIO 45246

313.771.4330

WILLIAM P. COLE

FOR

WILLIAM P. COLE

WILLIAM P. COLE

WILLIAM P. COLE

WILLIAM P. COLE

Preceding page blank

D-2

CHARCOAL ABSORPTION GAS RECORD SHEET

AMBIENT VINYL CHLORIDE SURVEY

SAMPLER SERIAL NO. 10 ADJUSTING VALVE 253

SITE Anywhere, Ohio 123 64 Ave
(City or Town) (Street or Location)

WIND	VISIBILITY	SEV	HUMIDITY	TEMP. °F
DIRECTION ☐ CALM ☒ LIGHT ☐ GUSTY	☒ CLEAR ☐ HAZY	☐ CLEAR ☒ SCATTERED ☐ OVERCAST	☐ DRY ☒ MODERATE ☐ HUMID ☐ RAINY	☐ 4-20 ☒ 20-30 ☐ 30-40 ☐ 40-50 ☐ 50-60
DATE <u>2-15-75</u>	METER READING	REMARKS & UNUSUAL CONDITIONS OR ACTIVITIES NEAR THE SITE		
<u>3000 TO 2500</u> <u>PSIG</u>	START <u>20.0</u>	Start Time <u>4:10 P.M.</u> Flow <u>175 cc/min</u>		
☒ OTHER EXPLAN.	END <u>20.0</u>	End Time <u>4:20 P.M.</u> Flow <u>175 cc/min</u>		
<i>Joe Smith</i>				

Figure 1 Example of Data Record Sheet

° INTRODUCTION °

Within the past few months, vinyl chloride has been demonstrated to be a carcinogen. It has been detected in the atmosphere surrounding both vinyl chloride monomer plants and polymerization plants. As a result of these discoveries, control regulations are being formulated and proposed for these plants.

The presence of vinyl chloride in the atmosphere surrounding polyvinyl chloride fabrication plants has not yet been demonstrated. If it does exist, then State Implementation Plans may have to be modified to require surveillance monitoring around these plants. The purpose of this study is to determine whether the concentration of vinyl chloride is of such magnitude that SIP's will have to be modified.

INSTALLATION OF EQUIPMENT

PEDCo-Environmental will select the sampling site and install the sampler.

OPERATION OF EQUIPMENT

Sampling will be performed at four locations for a period of 15 consecutive days. Each day the sampler is to be serviced at the same time such that a 24-hour (± 15 minutes) sample is collected. The operator will adjust his schedule such that sufficient travel time between sites is

sites is provided. Anticipation of traffic delays and weather conditions should be included when preparing this schedule. The following steps are procedures that should be followed while servicing a sampler site:

1. Record the sampler serial number on the record sheet (see example Figure 1) and on the operator's log sheet provided in Appendix A.
2. Record the adsorption tube number, site location and sampler location on the same data and operator's log sheets.
3. Record the vacuum reading (reading must be in excess of 16 inches of mercury). Should vacuum be less than 16 inches Hg., check sampler for leaks or replace sampler with spare sampler supplied.
4. Remove the light and rain shield from the sampler.
5. Remove the rubber caps from the adsorption tube ends and connect the adsorption tube to the sampler.
6. Connect the Rotometer to the adsorption tube and record the initial flow, as derived from the Rotometer calibration curve, on the record sheet and on the operator's log sheet.
7. Remove the Rotometer and connect the light and rain shield.
8. Record the starting date and time on the record sheet and on the operator's log sheet.
9. Return to the sampling site after 24-hours (+ 15 minutes) and record the date, time and the end vacuum readings.
10. Remove the light and rain shield and connect the Rotometer and record the final flow as in Step 6.
11. Disconnect the adsorption tube and place the rubber caps on each end.
12. Place the adsorption tube and the record sheet in the special shipping box provided.

13. Begin a new sampling period (refer to Step 1).
14. After two days of sampling, immediately send the samples collected in one box (five samples in each foam rubber layer) via air mail to the PEDCo laboratory.

METEOROLOGICAL DATA

Each day meteorological data from the nearest Weather Bureau Station or local airport will be collected. Hourly averages for wind speed and direction will be obtained and recorded on the form provided in Appendix B.

OPERATORS DAILY LOG

Site Location _____ Site Number _____

[illegible]

Preceding page blank

APPENDIX E
AMBIENT VINYL CHLORIDE DATA SUMMARY

AMBIENT VINYL CHLORIDE DATA
FORD MOTOR COMPANY VINYL PLANT - MOUNT CLEMENTS, MICHIGAN

Date sampled	Site	ug/m ³	PPH	Date sampled	Site	ug/m ³	PPH
2/11/75	A	<1	<0.5	2/19/75	A	3.8	1.5
	B	2.0	0.8		R	17.9	7.0
	C	1.5	0.6		C	4.4	1.7
	C	<1	<0.5		D	4.4	1.7
2/13/75	D	<1	<0.5	2/20/75	A	<1	<0.5
	A	<1	<0.5		B	<1	<0.5
	B	<1	<0.5		C	<1	<0.5
	C	6.8	2.7		D	<1	<0.5
2/14/75	C	5.3	2.1	2/21/75	A	<1	<0.5
	D	<1	<0.5		B	<1	<0.5
	A	<1	<0.5		C	<1	<0.5
	B	<1	<0.5	2/22/75	C	<1	<0.5
2/15/75	C	<1	<0.5		D	<1	<0.5
	D	<1	<0.5		A	<1	<0.5
	A	<1	<0.5		B	<1	<0.5
2/16/75	B	<1	<0.5	2/23/75	C	<1	<0.5
	C	<1	<0.5		C	<1	<0.5
	D	<1	<0.5		D	<1	<0.5
	A	<1	<0.5	2/24/75	A	<1	<0.5
2/17/75	B	<1	<0.5		B	<1	<0.5
	C	<1	<0.5		C	<1	<0.5
	C	<1	<0.5		C	<1	<0.5
2/18/75	D	<1	<0.5	2/25/75	D	<1	<0.5
	A	1.7	4.3		A	<1	<0.5
	B	<1	<0.5		B	<1	<0.5
	C	<1	<0.5		C	<1	<0.5
	D	<1	<0.5		D	<1	<0.5

AMBIENT VINYL CHLORIDE DATA
G.T.M. SYLVANIA INC., PLANT - WARREN, PENNSYLVANIA

Date sampled	Site	$\mu\text{g}/\text{m}^3$	PPB
2/15/75	A	<1	<0.5
	A	<1	<0.5
	B	<1	<0.5
	C	<1	<0.5
	D	<1	<0.5
2/16/75	A	<1	<0.5
	B	<1	<0.5
	C	<1	<0.5
	D	<1	<0.5
	D	<1	<0.5
2/17/75	A	<1	<0.5
	B	<1	<0.5
	C	<1	<0.5
	D	<1	<0.5
	D	<1	<0.5
2/18/75	A	<1	<0.5
	B	<1	<0.5
	C	<1	<0.5
	D	<1	<0.5
	D	<1	<0.5
2/19/75	A	<1	<0.5
	B	<1	<0.5
	C	<1	<0.5
	D	<1	<0.5
	D	<1	<0.5
2/19/75	A	<1	<0.5
	B	<1	<0.5
	C	<1	<0.5
	D	<1	<0.5
	D	<1	<0.5
2/20/75	A	<1	<0.5
	B	<1	<0.5
	C	<1	<0.5
	D	<1	<0.5
	D	<1	<0.5
2/21/75	A	<1	<0.5
	B	<1	<0.5
	C	<1	<0.5
	D	<1	<0.5
	D	<1	<0.5
2/22/75	A	<1	<0.5
	A	<1	<0.5
	B	<1	<0.5
	C	<1	<0.5
	D	<1	<0.5
2/23/75	A	<1	<0.5
	A	<1	<0.5
	B	<1	<0.5
	C	<1	<0.5
	D	<1	<0.5
2/24/75	A	<1	<0.5
	B	<1	<0.5
	C	<1	<0.5
	D	<1	<0.5
	D	<1	<0.5
2/25/75	A	<1	<0.5
	A	<1	<0.5
	B	<1	<0.5
	C	<1	<0.5
	D	<1	<0.5
2/26/75	A	<1	<0.5
	A	<1	<0.5
	B	<1	<0.5
	C	<1	<0.5
	D	<1	<0.5
2/27/75	A	<1	<0.5
	B	<1	<0.5
	C	<1	<0.5
	D	<1	<0.5
	D	<1	<0.5
2/28/75	A	<1	<0.5
	B	<1	<0.5
	C	<1	<0.5
	D	<1	<0.5
	D	<1	<0.5
2/29/75	A	<1	<0.5
	B	<1	<0.5
	C	<1	<0.5
	D	<1	<0.5
	D	<1	<0.5

AMBIENT VINYL CHLORIDE DATA
CONGOLEUM INDUSTRIES PLANT - MARCUS HOOK, PENNSYLVANIA

Date sampled	Site	ug/m ³	PPH	Date sampled	Site	ug/m ³	PPB
3/12/75	A	<1	<0.5	3/19/75	A	1.3	0.6
	B	<1	<0.5		B	6.8	2.7
	C	<1	<0.5		C	1.7	0.7
	D	<1	<0.5		D	1.6	0.6
3/13/75	A	<1	<0.5	3/20/75	D	1.5	0.7
	B	<1	<0.5		A	3.5	1.3
	C	<1	<0.5		B	2.5	1.3
	D	<1	<0.5		C	4.0	1.6
3/14/75	A	<1	<0.5	3/21/75	D	2.5	1.0
	B	<1	<0.5		A	5.4	2.2
	C	<1	<0.5		B	9.0	3.5
	D	<1	<0.5		C	5.9	3.5
3/15/75	A	<1	<0.5	3/22/75	D	5.9	2.4
	B	<1	<0.5		D	6.2	2.5
	C	<1	<0.5		A	2.0	0.8
	D	<1	<0.5		B	10.1	3.9
3/16/75	A	<1	<0.5	3/23/75	C	3.0	1.2
	B	<1	<0.5		D	2.8	1.1
	C	<1	<0.5		D	2.5	1.0
	D	<1	<0.5		A	6.1	2.4
3/17/75	A	2.6	1.0	3/24/75	B	10.3	4.0
	B	<1	<0.5		C	7.0	2.7
	C	<1	<0.5		D	6.3	2.5
	D	<1	<0.5		A	2.6	1.0
3/18/75	A	3.0	1.2	3/25/75	B	4.1	1.6
	B	<1	<0.5		C	2.5	1.0
	C	<1	<0.5		D	2.7	1.1
	D	<1	<0.5		A	<1	<0.5
3/19/75	A	3.1	1.2		B	2.0	0.8
	B	7.0	2.7		C	2.2	0.8
	C	2.1	1.0		D	2.2	0.9
	D	3.8	1.5			2.2	0.8

AMBIENT VINYL CHLORIDE DATA
REYNOLDS METALS COMPANY PLANT, PACKAGING DIVISION-PLASTICS - GROTTOPS, VIRGINIA

Date sampled	Site	µg/m ³	PPB
3/15/75	A	<1	<0.5
	B	4.7	1.8
	C	3.5	1.4
	D	<1	<0.5
3/16/75	A	<1	<0.5
	B	<1	<0.5
	C	<1	<0.5
	D	<1	<0.5
3/17/75	A	Lost sample	0.7
	B	1.6	0.7
	C	2.5	1.0
	D	1.0	0.7
3/18/75	A	<1	<0.5
	B	<1	<0.5
	C	<1	<0.5
	D	1.2	0.5
3/19/75	A	3.3	1.2
	B	2.6	1.0
	C	2.7	1.0
	D	2.1	0.8
3/20/75	A	2.8	1.1
	B	5.3	2.0
	C	4.0	1.6
	D	2.6	1.0
3/21/75	A	3.8	1.5
	B	5.3	2.0
	C	4.1	1.7
	D	4.3	1.5
3/22/75	A	3.9	1.6
	B	2.9	1.1
	C	3.5	1.3
	D	4.3	1.7
3/23/75	A	3.9	1.6
	B	4.0	1.6
	C	4.3	1.7
	D	3.1	1.2
3/24/75	A	4.0	1.6
	B	4.3	1.7
	C	3.0	1.2
	D	2.0	0.8
3/25/75	A	2.6	1.0
	B	2.4	0.9
	C	1.2	0.4
	D	1.5	0.6
3/26/75	A	1.2	0.4
	B	1.6	0.6
	C	1.6	0.6
	D	<1	<0.5
3/27/75	A	<1	<0.5
	B	<1	<0.5
	C	<1	<0.5
	D	<1	<0.5
3/28/75	A	1.3	0.6
	B	1.3	0.5
	C	1.5	0.6
	D	1.1	0.4
3/29/75	A	<1	<0.5
	B	<1	<0.5
	C	<1	<0.5
	D	<1	<0.5
Tube broken when received.			

AMBIENT VINYL CHLORIDE DATA

ITT, ROYAL ELECTRIC DIVISION PLANT - PAWTUCKET, RHODE ISLAND

Date sampled	Site	µg/m ³	PPB
4/10/75	A	<1	<0.5
	B	<1	<0.5
	C	<1	<0.5
	D	<1	<0.5
4/11/75	A	<1	<0.5
	B	<1	<0.5
	C	<1	<0.5
	D	<1	<0.5
4/12/75	A	<1	<0.5
	B	<1	<0.5
	C	<1	<0.5
	D	<1	<0.5
4/13/75	A	<1	<0.5
	B	<1	<0.5
	C	<1	<0.5
	D	<1	<0.5
4/14/75	A	<1	<0.5
	B	<1	<0.5
	C	<1	<0.5
	D	<1	<0.5
4/15/75	A	<1	<0.5
	B	<1	<0.5
	C	<1	<0.5
	D	<1	<0.5
4/16/75	A	<1	<0.5
	B	<1	<0.5
	C	<1	<0.5
	D	<1	<0.5

AMBIENT VINYL CHLORIDE DATA
CHARLOTTE PIPE AND FOUNDRY CO., CHARLOTTE PLASTICS DIVISION PLANT - MONROE, NORTH CAROLINA

Date sampled	Site	Date analyzed	ug/m ³	PPB
5/22/75	A	6/2/75	<1	<0.5
	B	6/2/75	<1	<0.5
	C	6/2/75	<1	<0.5
	D	6/2/75	<1	<0.5
5/23/75	A	6/2/75	<1	<0.5
	B	6/2/75	<1	<0.5
	C	6/2/75	<1	<0.5
	D	6/2/75	<1	<0.5
5/24/75	A	6/2/75	<1	<0.5
	B	6/2/75	<1	<0.5
	C	6/2/75	<1	<0.5
	D	6/2/75	<1	<0.5
5/25/75	A	6/2/75	<1	<0.5
	B	6/2/75	<1	<0.5
	C	6/2/75	<1	<0.5
	D	6/2/75	<1	<0.5
5/26/75	A	6/2/75	<1	<0.5
	B	6/2/75	<1	<0.5
	C	6/2/75	<1	<0.5
	D	6/2/75	<1	<0.5
5/27/75	A	6/2/75	<1	<0.5
	B	6/2/75	<1	<0.5
	C	6/2/75	<1	<0.5
	D	6/2/75	<1	<0.5
5/28/75	A	6/2/75	<1	<0.5
	B	6/2/75	<1	<0.5
	C	6/2/75	<1	<0.5
	D	6/2/75	<1	<0.5

Date sampled	Site	Date analyzed	ug/m ³	PPB
5/29/75	A	6/4/75	<1	<0.5
	B	6/4/75	<1	<0.5
	C	6/4/75	<1	<0.5
	D	6/4/75	<1	<0.5
5/30/75	A	6/4/75	<1	<0.5
	B	6/4/75	<1	<0.5
	C	6/4/75	<1	<0.5
	D	6/4/75	<1	<0.5
5/31/75	A	6/4/75	<1	<0.5
	B	6/4/75	<1	<0.5
	C	6/4/75	<1	<0.5
	D	6/4/75	<1	<0.5
6/1/75	A	6/9/75	<1	<0.5
	B	6/9/75	<1	<0.5
	C	6/9/75	<1	<0.5
	D	6/9/75	<1	<0.5
6/2/75	A	6/9/75	<1	<0.5
	B	6/9/75	<1	<0.5
	C	6/9/75	<1	<0.5
	D	6/9/75	<1	<0.5
6/3/75	A	6/9/75	<1	<0.5
	B	6/9/75	<1	<0.5
	C	6/9/75	<1	<0.5
	D	6/9/75	<1	<0.5
6/4/75	A	6/9/75	<1	<0.5
	B	6/9/75	<1	<0.5
	C	6/9/75	<1	<0.5
	D	6/9/75	<1	<0.5